EARLY KHARTOUM

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AN ACCOUNT OF THE EXCAVATION OF AN EARLY OCCUPATION SITE CARRIED OUT BY THE SUDAN GOVERNMENT ANTIQUITIES SERVICE IN 1944–5

BY

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To the memory of my wife Dorothy, who died in Eire during the excavation, and of Sir Douglas Newbold, who died in Khartoum within a month of the completion of the excavation. Without their encouragement and support this work would not have seen the light of day.

PREFACE

THE Anglo-Egyptian Sudan is a vast country, just under a million square miles in area, which lies between Egypt and the rest of the African continent. It is work in Egypt during the last century or so which has enabled historians in that country, and in lands to the north and east of it, to date with considerable precision the doings of man during the last five thousand years. Much archaeological research has also been done in South Africa and east Africa, as well as in the other vast areas of that continent; but as long as the history and prehistory of the Sudan, as distinct from that of Egypt, remains unknown, it is impossible to relate finds in these other areas to finds that have been made in Egypt, and so to date them with any accuracy. Thus, when the Sudan Government Antiquities Service turned its attention from conservation of ancient monuments to active research into the past of the Sudan by excavating an early occupation site at Khartoum, an event occurred which is of importance not only to the Sudan but to the rest of Africa west and south of it. The circumstances under which the Sudan Government Antiquities Service came to undertake this, its first, excavation are related in Chapter I. The backbone of the Service now consists of several young Sudanese. Before them lies an adventurous and honourable career in preserving the visible ancient monuments of their country and in bringing to light and reconstructing, from remains that will often be as fragmentary and unpromising as those of Early Khartoum, the history of their land, much of which is at present unknown. If they do this work carefully and conscientiously, they will earn the gratitude not only of their countrymen but of archaeologists and prehistorians all over Africa. I therefore hope that this will be but the first of many researches into the Sudan's past to be undertaken and published by the Sudan Government Antiquities Service.

My own duties as Commissioner for Archaeology and Anthropology were such that, when this excavation was finished, time could only be found for writing the report during the summer months, when, to a European at least, the Sudan weather is too hot for trekking and conservation work, and the mind, as well as the body, has to be driven unwillingly to work. I could not have produced this volume without the help of many people, and my grateful thanks to most of them are recorded in the text, where the help that they gave is acknowledged. But there are a few debts of gratitude which it has been impossible to acknowledge adequately in the text; and this I endeavour to do here.

The reports by Dr. D. E. Derry on the human remains and on a selection from the fossil remains of the vertebrate fauna, and the report by Miss D. M. A. Bate on the vertebrate fauna have greatly added to the value of the book. Miss Bate's report, besides summarizing all that was known hitherto about vertebrate fossils from the upper Nile valley, has provided most valuable confirmation of the archaeological evidence, which before receiving this support threw some light on the connexions that must have existed between the Nile valley in the vicinity of Khartoum and the southern Sahara at the time of the early settlement. Indeed her report has enabled me to be much more definite than I could otherwise have been in Chapter XI, much of which was rewritten on receipt of it. More than this, the book has benefited greatly in many other ways from the interest which she has taken in it and the discussions which I have had with her on various points. It is thanks largely to her that it is now not the mere record of an excavation which had to be undertaken by the Sudan Government Antiquities Service but a work that will have to be taken into consideration by prehistorians in north Africa and elsewhere, and one that will, I hope, encourage others, particularly in French north and west Africa, to elucidate still further the early connexions between the Nile valley and lands far to the west of it. For it now reveals some of the connexions that must have existed before the oncoming desert initiated movements of man and animals from the Saharan steppe in the direction of more favourable areas

such as the Nile valley, and then with increasing intensity finally put an end to them. Some idea of the distance from the Nile at which some of those movements must have started is indicated not only by the pottery and bone spears from the Wadi Azaouak sites but also by the fact that the gouges typical of the Fayum Neolithic B must have come from a source (apparently Ténéré, for which see Plate 101) so far away that they could reach two points in the Nile valley a thousand miles apart without apparently arriving anywhere between them.

Several of Professor Raymond Vaufrey's works, which are included in the Bibliography, did not become available to me until after the book had gone to press, or more reference would have been made to his work in Chapter XI.

The illustration of an archaeological report is its most important part. I hope that before long there will be Sudanese artists and photographers capable of such work. In the absence of any such artist in the Sudan, Miss G. Sowerby was engaged from Oxford, and all the line drawings on Plates 13, 15, 21, 27, 29, 31–2, 36–7, 94–100, and 107–8 are her work, except for some of the drawings on Plates 13, 15, and 21 which were most kindly done in her exiguous spare time by Miss L. M. Witherspoon, then Principal of the Girls' Training College, Omdurman.

How much I owe to Mr. J. Hudson-Davies of the Sudan Posts and Telegraphs Department for all the best photographs of small objects I only realized in full when pressure of his own work kept him from going on with the photography (all of which had been done in his spare time on hot afternoons). I had then to put into practice myself what I had learned from him, and I soon found how very great is his skill, to which his photographs on Plates 46–70, 72–87, 89, 90, 109, 110, and 112 are eloquent testimony. Only those who have worked in high temperatures with high humidity and unfavourable lighting conditions will realize the difficulty of obtaining good photographic results with inferior chemicals and papers from miniature films, the best of which do not equal in quality those obtainable in 1939. (All Mr. Hudson-Davies's work was done with an Exacta and mine with a Leica camera.)

My friend, Mr. W. F. Senior, the Chief Transport Officer, helped me with the artificial lighting which was used in photographing most of the quartz artifacts and also the pots on Plates 91–3.

To the authorities of the Musée de l'Homme in Paris, and particularly to M. Harper-Kelley, I am indebted for permission to photograph the selection of sherds from Taferjit and Tamaya Mellet excavated by M. Henri Lhote and reproduced on Plate 102.

Mr. Gerald Andrew, the Government Geologist, besides contributing a great deal by advice and discussion to Chapter II, was ready at any time, with unfailing good humour however busy he was, to help with the determination of materials.

The following members of the Sudan Government Antiquities Service deserve special mention: Sadik Eff. el Nur, who was my efficient adjutant and kept the office going while I was tied in person to the excavation, Osman Eff. Mohamed Khalil, who was always ready to tackle the typing necessitated by the report, Abdelrahman Eff. el Fiki, who patiently and uncomplainingly worked long hours numbering many thousands of small objects from the excavation, and who reconstructed many of the pots described in Chapter X, and Abdelrahman Mohamed the museum attendant, who was always at hand and ready to tackle willingly and intelligently whatever job was asked of him.

In the actual production of the book it has been a pleasure to work with the staff of the Oxford University Press, and I must particularly mention the unfailing efficiency, helpfulness, and interest of Mr. G. J. Halsey of the Oxford University Press and of Mr. L. Dailley of Messrs. Craske, Vaus and Crampton Ltd., the blockmakers.

And last, and by no means least, I have to acknowledge how much I owe to Miss G. Caton-Thompson for ready help whenever it was sought and for encouragement. At one time I had hoped that she would have undertaken the excavation, and I only trust that the results obtained by her less experienced

understudy will meet with her approval. To Dr. E. J. Baumgartel also I am grateful for thought-provoking discussions and the suggestion that I should look for really early pottery south of the Second Cataract.

The Sudan Government, which has financed the excavation and publication of this report, will not, as it was originally hoped, obtain the return in full of its outlay, even in the event of the whole edition being sold; but it is to be hoped that the return that the Sudan will obtain in increased knowledge about its early inhabitants and the changes that have occurred since their time in climatic conditions and the height of the Nile, will be of such benefit to the present inhabitants of the country that the expenditure will be recognized to have been, as I am sure it was, fully justified. Particularly will this be the case if it is realized in the Sudan that where man lives on the margin between two types of environment, as between the desert and the steppe, his actions in a very few generations may tip the balance and turn the steppe into desert, without any external factors influencing the climate. It must be left to future investigation to show whether any factors other than the actions of man have affected the area between Khartoum and the southern Sahara since the days of Early Khartoum, or whether it is man that is entirely to blame for the considerable southerly advance of the desert that this book shows has taken place since then. If the latter is the case and it is clearly realized, it should not be difficult to halt the desert where it now is, and even to some extent to bring back the steppe. The Soil Conservation Board is already tackling such problems, but as the *Report of the Soil Conservation Committee* (1944) pointed out, their action to be effective must be based on right knowledge, and that knowledge was not then sufficiently advanced. To have added materially to the present body of knowledge on the subject and so to help bring about the removal of one of the greatest threats to the future of the Sudan, will alone be a handsome return for the expense of the excavation. And there is surely also value in disclosing to the present inhabitants of the Sudan some new facts about the life of their early forebears.

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PART I

CHAPTER I

A DESCRIPTION OF THE SITE AND EXCAVATION

THE site consists of a low mound situated north-east of the Khartoum Central railway station and east of the Civil Hospital in Blocks IV LE, V KE, and V LE of the town plan. The most conspicuous features on the surface of the mound before the excavation began were fragments of broken red brick from Moslem tombs dating from just before the siege of Khartoum in A.D. 1885 which have fallen into ruins, and a fine *sayal* (*Acacia spirocarpa*) tree which crowns the top of the mound. It was indeed one of the two main cemeteries of the city during the siege of Khartoum, being just within the defended perimeter, as may be seen on the plan of Khartoum and Omdurman in *Fire and Sword in the Sudan* by Rudolf C. Slatin. It was the disturbance caused by the many graves from this period, dug one on top of the other in many cases, that made the excavation of our site, of its own nature difficult to excavate, doubly difficult. It is pertinent here to recall the conditions prevailing in Khartoum during the last months of the siege by quoting the extract from Bordeini Bey's journal given on p. 166 of *Mahdism and the Egyptian Sudan* by F. R. Wingate:

> The civilians were even worse off. Many died of hunger and corpses filled the streets: no one even had the energy to bury them. Gordon Pasha then ordered four guards, one guard for each quarter of the town, to bury the dead. But even these could not carry out the duty, so he issued an order that anyone who buried a corpse should receive a reward of two dollars, but even this proved of no avail.

It was only during the recent war, when, serving in an anti-aircraft company of the Sudan Auxiliary Defence Force, I had to spend long hours in a trench on this mound waiting for attacks on Khartoum by Italian aircraft, that I realized that the mound had any history earlier than the siege of Khartoum, and that it was in fact largely formed of the debris from a Stone Age settlement.

On close inspection it was seen that the mound was covered with a surface layer consisting almost entirely of waste flakes of quartz and rhyolite, some cores and pebbles of the same materials, many sherds of a hard red pottery with a distinctive decoration when not badly weathered, a number of upper grindstones, hammer-stones, and broken ring-stones of sandstone, and fossil bone fragments. It was no doubt this layer of stones and sherds that was largely responsible for the existence of the mound, for, besides the fact that every stone on the site must have been brought there by man, since the surrounding ground is flat silt-cemented sand in places covered with coarser drift sand, but entirely devoid of stone, it soon became clear that, as Miss Caton-Thompson found in the Fayum,[1] the mound had been a sand-hill considerably eroded, until the erosion had been arrested by the formation of a protective cap of coarser material. That erosion has continued to lower the flats of silt-cemented sand that surround the mound, since the mound with its protective cap of debris attained comparative stability, is clear on the north and west sides; for in Block III LE to the west between the mound and the present eastern boundary of the Civil Hospital, and in Block V IE between the mound and Sultan Avenue to the north, the surface of the ground is in places white with fragments of human skeletons which are now exposed on the surface of the ground, although they must have been buried 4 to 6 ft. deep not more than a century ago. Probably in many cases they are less old than that, for Khartoum was only founded in 1820.

[1] *The Desert Fayum*, vol. i, p. 24.

Realization of the nature of this mound led to the discovery of several other mounds of similar nature round the junction of the Blue and White Niles.

When I was on leave in Kenya in 1941 I showed a hammer-stone or pebble fabricator of the type shown in Pl. 15, Fig. 18, from this site to the late Archdeacon W. E. Owen, and he said that careful search would reveal backed blades there, as he had always found them associated with this type of hammer-stone in east Africa; and indeed on my return to Khartoum backed blades and crescents of rhyolite and quartz, of the types shown on Pl. 13, were soon found.

A report of the nature of the site was then made to the Archaeological and Museums Board; and the Board at a meeting held on 28 January 1942 decided that action should be taken under the Antiquities Ordinance to preserve the site from being built on until it had been excavated.

In September 1943 the Governor of Khartoum requested that the site should be excavated as soon as possible, as it was urgently required for the extension of the Civil Hospital; and at a meeting held on 28 June 1944 the Board instructed me to try to find someone from Egypt to help me undertake the excavation, as it would be impossible to obtain an excavator from Europe before the end of the war. Through the kind offices of the late Mr. Guy Brunton, O.B.E., of the Egyptian Antiquities Service, the services of Mr. F. Debono, who had been excavating a neolithic village site at Helwan, were obtained, and funds were approved for conducting a season's excavation of the site with four trained Quftis and prison labour, if the result of the preliminary exploration of the site should appear to the Board to warrant it.

The Grand Kadi agreed to the excavation of the site on condition that the bones from any Moslem grave disturbed should be reburied in a common grave in the cemetery south of the Khartoum Deims.

Mr. G. M. Brown and Dimitri Eff. Ibrahim Tadros of the Survey Department made a contour map of the site, showing 25-cm. intervals, and marked out the area that might have to be excavated in 4-metre squares, lines running (approximately) north to south being indicated by letters and those running east to west by numbers. The map on Pl. 4 is thus the result of their labours. Mr. Brown also drew Pls. 5 and 6 from my sketches; and Mr. R. C. Wakefield and Abdelrahman Eff. Ahmed prepared the map on p. 116 and took much trouble in drawing all these four plates in their final form. Grateful acknowledgement is made of all this valuable help that the Survey Department gave. The squares were marked out by pegs, and the level of the top of each peg taken. Whereas each square thus had four co-ordinates, for ease of reference the convention was adopted by which a square was referred to by the co-ordinates of the peg at its south-west corner.

Before excavation could begin, the site had to be enclosed, for many pedestrians normally walk over it on their way between the Deims and the town, and animals and the occasional vehicle use the tracks over it also. A bamboo fence with *sunt* posts was therefore erected by the Forestry Department, and night and day watchmen were appointed.

Mr. Debono reached Khartoum on 21 October 1944, and on 26 October 1944 the experimental excavation was begun. In order to teach the prisoners, who formed our unskilled labour, how to sieve, a square was first dug on a small isolated mound west of the main mound and situated in Block IV LE, where there were traces of occupation debris (sherds, quartz flakes, &c.) from the main mound, but which appeared to be disturbed, and possibly to have been brought there by subsequent human action, as there was an expanse of sand free of such debris between it and the main mound. In the event the contracted burial of an old man was found here, and subsequent discoveries make it seem probable (from the position of the skeleton and the condition of the bones) that this burial was of similar date to the Meroitic graves found in the main mound; but there were no grave goods. (This square was called square O.)

On 29 October 1944, the prisoners having achieved a reasonable proficiency in sieving, the experimental excavation of square M 17 in the main mound was begun, this square being selected as being apparently near the centre of the ancient settlement, and likely to show whether the site was worth excavating or not.

Working carefully with knife and brush, we gradually excavated this square, searching for any occupation debris that should show stratification and evidence of having remained undisturbed since the time when the mound was occupied. Below the surface it was found that there was a layer of loose grey sand containing many sherds, artifacts, and other fragments of stone, fragments of fossilized bone, animal, fish, and in a few cases human, fragments of *Ampullaria* and *Limicolaria* shell, and some complete shells of these molluscs. This layer varied in depth between 1 and 2 metres, and had in many places been obviously disturbed by nineteenth-century burials (on the average about ten such burials were subsequently found in each 4-metre square). The majority of the larger sherds were within 30 cm. of the present surface.

Below the uniformly grey sand was found loose yellow sand with small pockets of grey sand containing small fragments of pottery, artifacts, and shells, which it eventually became clear had worked their way from above down the holes made by the gerbils and other burrowing animals (see Pl. 3, Fig. 6).

Clay-bearing water had worked its way down some of these holes; and besides lining the burrows with typical Blue Nile clay, it had formed in the yellow sand local 'floors' of typical Blue Nile clay only 2 or 3 sq. ft. in area. Three such layers that were studied were at depths of 1 m., 1·40 m., and 2·15 m. from the surface (viz. R.L. 381·41, 381·01, and 380·267 m. respectively), and were seen to be interconnected by veins of similar clay running through the sand; and the explanation that is offered is that they were formed by the water of a high Blue Nile flood percolating from at least a level of R.L. 381·41 m. down animal burrows.

In order to make sure that there was no further occupation layer below the loose yellow sand, which contained small lime nodules and shells of *Zootecus insularis*, a pit was dug in the bottom of this square to an overall depth of about 6 m. No traces of further human occupation were found. For the section of this pit see Pl. 6, and for a discussion of the geology of the site see Chapter II.

Thus on 8 November 1944 it was possible to report to the Archaeological and Museums Board that we had found a layer containing occupation debris from the 'neolithic village' (as we then called it) over 1 metre in depth, and that, although it was disturbed by recent burials, there was a hope that undisturbed patches would be found. We had found in this layer a 4-barbed 'harpoon' or spear-head of bone, of a type of its own (Pl. 46, Fig. 1), and fragments of several other such 'harpoons', this type of weapon being hitherto unknown in the Sudan, a few small pieces of decorated bone, an interesting range of microlithic crescents, trapezes, borers, &c., indicating a stone culture new to the Sudan, and the sherds of a type of pottery hitherto unpublished. We had also found fragments of two fossilized human skulls, that were no doubt contemporary with the early settlement, in the debris from which we had found both the shells of *Limicolaria flammata*, a land snail that now rarely occurs north of Sennar, and the seeds of *Celtis integrifolia* (Pl. 45, Fig. 3), a tree also no longer known north of the Sennar area, indicating an average annual rainfall at Khartoum at the time of the village at least equal to that at Sennar at the present day (461 mm.), or three times as heavy as the present Khartoum average. On this report the Board recommended further excavation of the site, and funds were approved that would enable us to carry out three months' excavation, employing four trained Quftis from Egypt with prisoners for all unskilled labour.

A telegram was sent to Egypt for the Quftis as soon as further excavation was authorized; and on 23 November 1944 a broadcast on the Omdurman radio about the excavation was given by request.

While waiting for the Quftis to arrive, Mr. Debono and I tackled two more squares, M 24 and M 25. After removing the loose surface sand and objects, we removed a layer of yellow drift sand which was obviously subsequent in date to the settlement, and then proceeded to clear the recent burials from the square in which we were working.

ABSENCE OF STRATIFICATION

It will be of interest here to describe, for the benefit of future excavators of similar sites, our efforts to distinguish undisturbed occupation debris from that which had been subsequently disturbed. In all our excavation we found nothing more than small local layers of sand or debris seldom more than 1 cm. thick or more than a few inches in length in any one place that could be said to be stratified, and they were too small to be of any archaeological value. Not a hearth, post-hole, or other trace of any building could be distinguished. It was always grey sand of varying firmness, with varying distribution of sherds, stone and shell fragments, &c., completely unstratified. As often as not, when it was rather firmer than usual, it was found that it had been disturbed at some time, the disturbance having presumably introduced a little additional clay to the sandy occupation debris, the clay having a certain cementing effect.

Thus relative firmness proved unreliable as a factor for distinguishing disturbed from undisturbed soil. The discovery of objects that must have been introduced subsequent to the time of the early settlement, such as sherds of Meroitic or modern pottery or fragments of red or mud brick, or other objects of recent date, made it possible to establish that some soil had certainly been disturbed, but there was little else by which disturbance could be distinguished for certain. It was noticed that frequently when the soil had been removed and replaced, as in the filling of a recent grave, the objects in the grey sand (fragments of shell, stone, bone, and pottery, &c.) were more uniformly distributed than in soil where we had reason to think there had been no disturbance. Also in the area of the early settlement proper (as distinct from what is taken to be the old river flood plain to the north of the settlement, i.e. from approximately square M 28 northwards) the presence of a number of *white* shell fragments could usually be shown to indicate disturbance of the soil, if they had not been washed down a burrow from the surface; for in the grey sand the shell fragments are all covered with a thin grey calcified layer, which layer is lost when the fragments are exposed on the surface.

Other criteria which were tested proved definitely useless, e.g. the position of sherds. I wondered for a time whether the discovery of a sherd of some size in a vertical position did not indicate disturbance, for it might have been thought that sherds falling naturally on the ground would assume a horizontal position; but eventually, anyhow in the flood-plain area in the northern end of trench M, where it was clear that there had been no subsequent disturbance, sherds were found in all positions, and Mr. Debono confirmed that he had found the same to be the case at Helwan.

Numerous lumps of shell fragments, containing also whole shells, fish-bones and other bone fragments, and sometimes sherds, stone fragments, and even pieces of bone 'harpoons' or *Celtis* seeds, all cemented together with kankar, these concretions varying in size from a fraction of an inch to 6 in. or more in length, and up to 3 or 4 in. in depth (see Pl. 45, Fig. 4, Pl. 51, Figs. 1–3, and Pl. 59, Fig. 2), were found, both on the surface and in the grey sandy layer; and for a time it was thought that they must have come from a continuous layer that had been broken up by subsequent disturbance; and their presence in a layer was taken to be evidence of disturbance. But this supposition also turned out to be misleading—for these concretions were found to have formed locally in pockets of various sizes, and not to have come from any continuous layer.

(One such pocket was subsequently found at a depth of 90 cm. in square L 25, where it had been

partly cut through by a recent grave. It contained a thick black deposit of sherds, bones, teeth, fragments of a horn core, shells, hammer-stones, the butt of a bone spear-head, and a 'fishing-line sinker', and was no doubt the debris of a habitation.

In square N 21 a similar large patch of loosely concreted debris was found at a depth of 24 cm. below the surface. It was lying on sand and contained many fragments of *Ampullaria* shell, quartz cores, sandstone ochre-grinders and other fragments of sandstone, a horn core, teeth of a large mammal, fish-bones, more than twenty *Celtis* seeds, and two ostrich egg-shell disk beads. A fragment of burnt clay from a wattle-and-daub erection was close to this concreted debris; and there seems little doubt that this was the site of another dwelling.)

By the end of November we had found in M 24 an area of a few square feet in size, after the removal of the recent graves which had cut through it, of almost solid *Ampullaria* shell fragments but containing some sherds, bones, worked stone fragments, &c., from the early settlement, that were taken to be undisturbed occupation debris, and which it is now known was undisturbed. Where, however, this layer changed from solid shell fragments to grey sand containing occupation debris it was impossible to be certain whether the grey sand had been subsequently disturbed or not.

We stopped work on M 24 at this stage, and I left Mr. Debono starting to clear M 31 and M 32 in a similar way, when on 1 December I had to leave Khartoum on urgent conservation duty.

The Quftis, 'Doktor' Ali Ibrahim and Ahmed Abdelmoneim, who had been working with Mr. Debono in Egypt, and Hofni Ibrahim and his brother Hussein Ibrahim, whom I obtained through Mr. Guy Brunton, arrived during my absence on 6 December. On their arrival Mr. Debono started them in pairs clearing squares in strip M working from M 17 northwards, and after removing the recent graves in the squares, excavating the soil that remained by conventional layers, at first 10 cm. in depth, and later 20 cm. in depth, the soil from these 'layers' being kept separate and sieved.

By the time I returned on 14 December they had already found—practically on the surface—the least disturbed human burial (M 20 (2)) and the largest fragment of a pot from the early settlement that we were to find, the latter having been apparently used as a pillow for the head in another burial (M 21 (2)). Unfortunately, of the photographs Mr. Debono took of these burials, one was a failure, and the others are not good (Pl. 8, Figs. 1–2). It was clear that the deposit under burial M 20 (2) could not have been disturbed, but it too showed no stratification, and examination of objects found under it disclosed no sequence in either pottery or stone implements.

On consideration, and reflecting on conditions in present-day villages and encampments situated on sand-hills in Kordofan and Darfur, it seems improbable that human occupation ever does leave much stratification where settlements are situated on loose sand. The continual churning of the surface by the feet of the inhabitants (and their animals) ensures that the sherds and other debris left by the earliest inhabitants are brought to the surface, while the sherds, &c., of the most recent inhabitants soon find their way down into the sand, and the result is a confusion of the archaeological evidence. And where, as we shall see in the present site, erosion is taking place, and the surface is being continually disturbed by traffic, the confusion of the occupation debris is all the more certain, as eventually all the debris is brought down to a common level. Burrowing animals, too, contribute their share to the confusion.

THE COURSE OF THE EXCAVATIONS

The excavation by Quftis of strip M was continued as far north as M 30, going down to natural soil (*jebel*), and keeping the soil from conventional layers, where it seemed to be undisturbed, separate for sieving. From M 17 to 21 the natural soil had been loose yellow sand at a depth of R.L. 381 to 382 m. From M 22 to 25 the natural soil was still almost pure quartz sand, but it became firmer, being more

and more cemented with clay. In M 25 its level dropped fairly sharply to the north, and in the bank so formed a kind of tunnel, full of looser sand containing some occupation debris, was found that may have been originally made by some large burrowing animal before the settlement came into existence. In square M 28 the natural soil was still falling gently to the north, but above it the soil which still contained occupation debris, particularly shell fragments, sherds, and pieces of worked sandstone *in situ*, was changing its nature. Although still largely composed of quartz sand, it was blackish in colour where the occupation debris was thickest, and very hard to dig.

We had found no traces of early burials north of M 21 (we did eventually find them in L 26, N 24, R 25), and it appeared probable that the sudden fall in level of the natural soil in M 25 indicated the approximate high river-bank of the Blue Nile at the time of the early settlement, with the debris in squares to the north of that dropped on the flood plain of the river. We were finding nothing but sherds, many of them water-worn, and a few artifacts, time was passing, and it was clear that we could not hope by the end of February to excavate half the site, so the Quftis were moved elsewhere, although four prisoners were kept digging northwards square by square, and they only finished M 36 after the Quftis had returned to Egypt in February.

At this stage excavation by conventional 20-cm. layers was stopped, as from squares M 18 to 30 there were so many separate piles to sieve that they were to keep the sieving gang employed till excavation stopped in February, and as examination of the sherds from layers so far sieved indicated that the various patterns of sherd occurred throughout the layers.

We then dug strip M southwards square by square, carrying it down to the sandy *jebel*; but the occupation layer here was all very loose and dusty, and nothing of interest was found apart from a contracted Meroitic burial in M 15, the pots of which Mr. Debono had found and removed while I was away on conservation duty. (These Meroitic burials came as a surprise, although one or two Meroitic sherds had been found on the surface of the mound before the excavation began.) By square M 10 it appeared that we had reached the southern limit of the occupation debris from the settlement, none of the debris in this part of the mound being in its original position, having presumably moved down the southern slope of the sand-hill on which the early people had lived.

We then dug the strip L 14 to 25 without finding any early burials, and the strip K 14 to 25 which followed was no more productive. It should be mentioned here that as we excavated we left 50 cm. on each side of every level peg, in order that our levels could be preserved for future checking; and thus the pegs were left on pillars 1 m. square (see Pl. 1); but so crumbling was the nature of the soil that in many cases the wind destroyed even these large pillars within a few weeks of their excavation. In order to save time we did not take strips K or L right down to *jebel*, but generally dug them to a depth of only 1 m., taking a square deeper whenever there was an indication that we might find something interesting, as when we found Meroitic graves in L 16, K 15, and L 21. Trenches carried down to *jebel* in one or two places showed that *jebel* was still soft yellow sand falling gradually in K to the west; and this, with no early burials in either K or L, appeared to indicate that we had probably reached the western limit of the early settlement, which seems to have been a small one congregated on the highest part of the sand-hill. To investigate what is now the highest point of the mound, J 14 and I 14 to the west were then dug, and these made it clear that the height in this area is unnatural, being due to an extra thickness of red-brick debris from nineteenth-century tombs.

It was then decided to tackle a small area east of M, although it had not been originally intended to do so, since that part of the site lies outside the area required in the immediate future for the extension of the Civil Hospital. But we wanted to find if possible an undisturbed burial from the early settlement; and so far M 20–1 had been in that respect the most productive area. We therefore dug strip N 19–25. N 20 produced traces of two disturbed early burials, N 21 the striking survival of only the

facial portions of a double burial (see Pl. 8, Fig. 6), and N 24 traces of two disturbed early burials. In N 25 the conditions apparently indicating the river-bank that we had found in M 25–6 were repeated.

Time was getting short, and, while there were other places to dig, we did not seem justified in destroying the fine tree that was growing in the centre of O–Q 23–5 and in disturbing the grave of Khadiga, the grandmother of Sir Sayed Abdel Rahman El Mahdi Pasha, who was buried somewhere in the vicinity of the tree, and to the removal of whose grave Sir Sayed Abdel Rahman had broad-mindedly agreed if it were necessary in the interests of science. It was therefore decided to examine the area to the immediate south of the tree, which promised the probability of more early burials, since these had occurred in M 20, N 20, M 21, and N 21. O–R 21 produced two badly disturbed early burials in O 21 only. A southward extension O–Q 20–19 produced none; so strip 22 was dug eastwards as far as T 22. This strip only produced traces of two badly disturbed early burials in Q 22; and S–T 22 gave the impression that, as was to be expected, we were there approaching the eastern limits of the site, since *jebel* began to fall away to the east. Our last few days were therefore spent carrying strip R northwards on the eastern side of the tree. This gave a hope of more early burials, since we had found them in Q 22, and in any case would provide further confirmation or otherwise of the river-bank theory, if we had time to continue it far enough. In the event we found traces of an early burial in R 25, while R 26, the last square that we were able to dig in this direction, besides producing a repetition of the steep fall in the *jebel* which is taken to confirm the river-bank theory, also gave us a second Meroitic burial with a stone thumb-ring and iron arrow-heads which, with a similar burial found a few days before in square Q 21, confirmed Mr. Emery's theory (Emery and Kirwan, 1938, pp. 233 ff. and figs. 87 and 88) that the externally tapering stone rings, which have been known to archaeologists in the Sudan for over thirty years, are indeed archers' looses (see p. 122).

THE SITE NOT COMPLETELY EXCAVATED

We have not completed the excavation of the site, and yet its strictly archaeological possibilities have probably been more or less exhausted, although until a site has been completely excavated one never knows; and the tree area (O–Q 22–4) may well produce a more complete early burial than we were able to find. Similarly the area south of N–S 19–15 would also be worth digging, although it is less likely to produce good early burials than Meroitic burials or other finds of interest later in date than the early settlement. Excavation of H–J 24–8 would also have been valuable, as the K–L 25–6 area was very thick in occupation debris, and besides producing traces of one burial, produced an unusually large proportion of bone 'harpoon' fragments.

It would have been most valuable as contributing to a more complete knowledge of the history of the Blue Nile, and of the climate and the soil between the present-day and Upper Palaeolithic times, to have been able to continue digging strip M north of M 36; but as this would have necessitated continuing a trench over 4 m. deep, it was beyond our resources. Similarly a deep trench to the south of M 10 would have shown whether the sand-hill on which the early settlement was situated was at one time on an island, like modern Tuti, and not on the left bank of the Blue Nile. The Government Geologist, Mr. G. Andrew, and I noticed shells of *Ampullaria*, *Lanistes*, and *Corbicula* at a depth of 2 to 3 ft. in clay silt in a trench cut in early 1944 for laying telephone cables near the north-west corner of the present British cemetery, about 300 yards south-east of the edge of our site. But against this southward extension of our trench, there was not only the time factor, but also the main road and the railway, which run past the site on the south side.

PLATE 1

GENERAL VIEWS OF THE SITE AND EXCAVATION

1. Distant view of the site from the south.

2. Distant view of the site from the west.

3. The excavation, looking NNW. from square N 19 towards square M 36.

4. The excavation, looking SSW. from square Q 20 towards square L 17.

5. The excavation, looking SE. from square K 25 towards square M 15.

6. The excavation, looking NE. from square K 16 towards square Q 22.

The positions from which the last four photographs were taken and the direction in which the camera was pointing are indicated by the arrows on Pl. 4.

EARLY KHARTOUM

GENERAL VIEWS OF THE SITE AND EXCAVATION

THE EXCAVATION

The old river bank and the band of white kankar

PLATE 3

THE EXCAVATION

1. The section at the west side of square L 25, with a line marked to show the probable upper limit of soil undisturbed since the time of the early settlement.

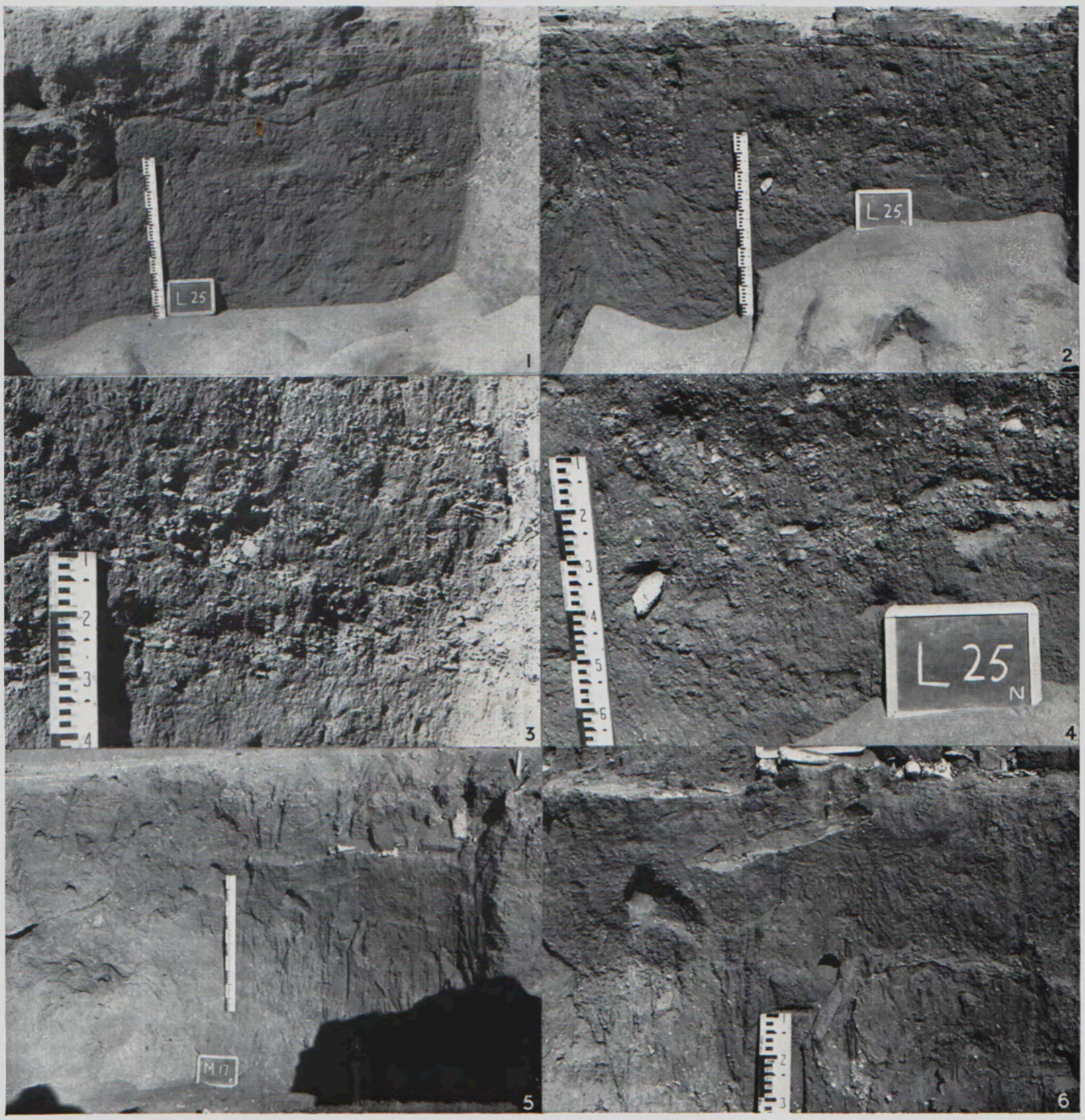
2. The section at the north side of square L 25.

3. Detail in the west section of square L 25, showing stone artifacts, *Ampullaria* shell fragments, &c.

4. Detail in the north section of square L 25.

5. The section of the east side of square M 17, showing part of an A.D. 1885 burial.

6. Detail in the east side section of square M 17, showing animal burrows lined with clay.



THE EXCAVATION

Some sections showing detail

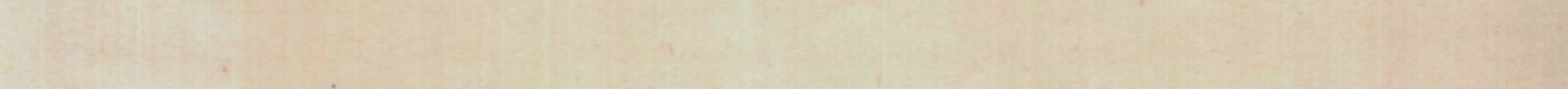
CONTOUR MAP

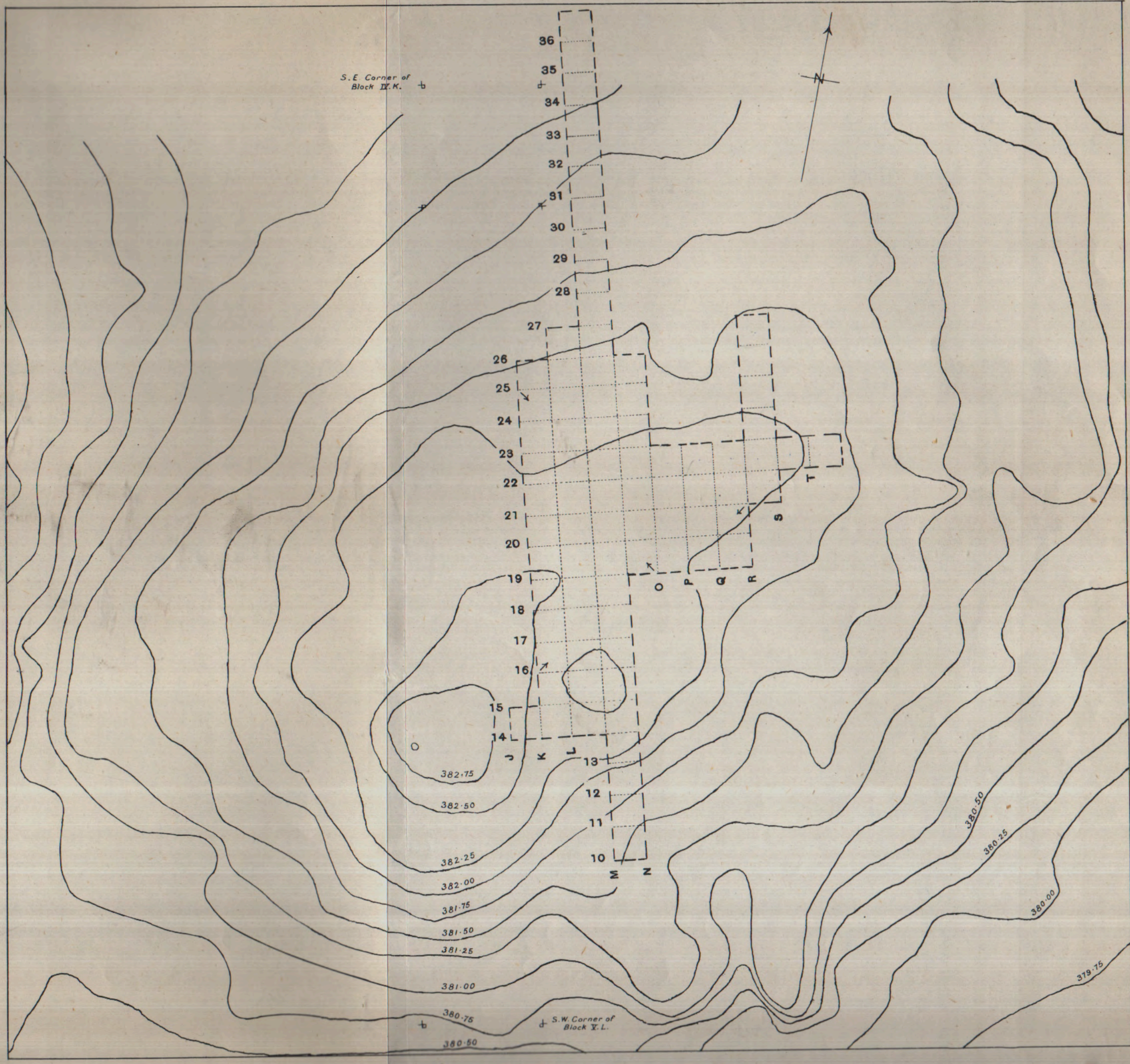
OF

KHARTOUM HOSPITAL SITE

Showing area excavated 1944/45

SCALE 1:500




S.E. Corner of Block IX.K.
S.W. Corner of Block X.L.
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CHAPTER II

THE GEOLOGY OF THE SITE

IN this chapter it will be shown that the early settlement was small in area and situated on the top of a sand-bank on the edge of the Blue Nile, which then rose during flood about four metres higher than it does to-day. Since the time of this early settlement about two metres have been eroded from the top of the sand-bank, and near the site on the north side a similar depth of sand has been deposited, resulting in a marked flattening of the topography and the burial of what was the Blue Nile flood-plain at the time of the settlement.

Surface conditions at the time of the early settlement

In the area K–M 17–18 (and probably N–Q 17–18) plus K–Q 19–21 the undisturbed soil below the occupation layer consists of loose fine buff sand (containing small friable calcareous concretions, kankar,[1] and shells of *Zootecus insularis* Ehrn.) and is usually within a metre of the present surface of the mound. A specimen of this sand has been examined by the Government Geologist, who reports that it consists mainly of grains of wind-blown sand similar to loose wind-blown sand now lying on the west bank of the Nile below Omdurman. This was probably blown into the river and thereafter formed a sand-bank in, or marginal to, the stream; and it seems clear that the early settlement was situated on this sand-bank just above the high-flood level of the Blue Nile of the time—indeed the clay layers in square M 17, mentioned on p. 3, seem to indicate that an exceptionally high river may have flooded the settlement, as often happens to Dinka villages situated on the edge of the upper White Nile, and is even more likely to happen on the edge of the Blue Nile with its greater rise and fall. Yet such is the laziness of man that he likes to live as close to his water-supply as possible.

This sand-bank appears to have fallen away to westward in strip K, to eastward about strip S, and to southward about strip 16. Early burials were found in M–N 20 and M–O 21 within 5 cm. of the surface, whereas similar burials were found in K 21 at a depth of 60 cm., in Q 22 at a depth of 3–35 cm., in R 25 at 40 cm., in N 24 at 46–63 cm., and in L 26 at 100 cm. Erosion therefore has been most severe in M–O 20–1—perhaps we may say in M–P 20–2—and this area may therefore be taken to have reached about R.L. 384 m. and to have been the highest part of the sand-bank at the time of the early settlement, and therefore probably the centre of the settlement. (In default of any evidence to the contrary and from the distribution of the burials, it is assumed that the early people probably buried their dead under the floor of their huts, as is still done in certain parts of the Sudan to-day, although it may well be that this site was only occupied seasonally, and that the 'huts' were little more than shelters or wind-screens of 'wattle and daub'. Indeed, a few human bones gnawed by hyenas (see p. 16) suggest that the site was unoccupied soon after those particular burials. Even in that case the shelters were probably near the top of the mound, and the dead buried under or near them.)

Between strips 22 and 25 the buff sand under the layer containing occupation debris is cemented with silt no doubt introduced from the river, and in strips 25–6 occurs the marked fall in level of this silt-cemented sand, that is interpreted as having been the true bank of the high Blue Nile at the time of the early settlement (see Pls. 2 and 5).

From strip 28 to strip 36 and northwards appears to have been the flood plain of the Blue Nile at

[1] Precipitated calcium carbonate in the form of a cement in porous sediments, a coating round pebbles and other large objects, calcareous rounded nodules or root-like rods in clays, or lenticular beds of freshwater limestone is of very common occurrence in arid areas such as Africa and India. For the sake of brevity the Indian term of kankar is used for all these forms of freshwater limestone deposits (see Holland and Tipper, 1913, p. 63), since the expression 'lime', frequently used, is an incorrect description of the material.

this time. It was only possible to excavate strip M in this area, and that only in a rough-and-ready way with prison labour, but it is probable that this strip is typical of those on either side of it.

In square M 27 shell fragments and other occupation debris occur in pockets, as in the rare undisturbed areas in the settlement proper.

In square M 28 debris from the early settlement, consisting of *Ampullaria* shell fragments, sherds, sandstone grinders and fragments, and some artifacts, was definitely *in situ*, as one might have expected it to be, thrown on the river-bank. No burials or fragments of burnt clay from wattle and daub (see p. 79), both probably indicating huts or shelters, were found north of strip 26 (see Pl. 4).

In square M 29 the occupation layer is continuous from top to bottom, and shell fragments occur at the bottom of it, though bone fragments are comparatively rare. In this square it looks as if the debris had been carried down from the river-bank proper on to soft ground, and is not lying as in M 28, where it is still presumably packed as it was discarded by man. In square M 29 two levels of debris begin to be distinguishable, the upper one consisting mostly of fragments of *Ampullaria* and *Limicolaria* shell with occasionally a whole *Limicolaria* shell, and a few small sherds and artifacts, including fragments of sandstone from 1 to 2 in. in diameter, and very rarely small fragments of bone. This is at R.L. 380 m., while the lower layer consists mainly of sherds and fragments of worked sandstone, with occasional artifacts of quartz or rhyolite, and rarely a fragment of bone. These two layers are still clearly distinguishable in square M 36, where they are at R.L. 378·9 m. and R.L. 378·2 m. respectively, having fallen gradually all the way from M 29 (see Pl. 5). No doubt they continue for some distance north of M 36.

Particularly around the lower layer and almost up to the upper layer, the deposit, which is largely sand,[1] is of a marked blackish colour, much compacted and hard to dig. A sample from 120 cm. deep in M 29 was submitted to the Government Geologist, who describes it as 'somewhat clayey sand, consisting mainly of a variety of quartz grains of all sizes, unsorted, some rounded, some fairly angular, with shell fragments fairly common, and small black elongated fragments, easily crushed and, when crushed, pale yellowish to brown, apparently isotropic'. He said that if associated with pottery and obvious bone (as they are) these black fragments, which presumably gave colour to the soil, should be rated as human debris. For the analysis of other samples from this black layer in square M 31 and M 36, see the table on p. 13. There seems to be little doubt that the black colour of this layer is due to the presence of organic matter from the early settlement.

In square M 31 these two layers are 60 cm. apart, but here as in M 29 and M 32 there are occasional sherds, artifacts, and shell fragments in between the two layers; and it appears probable that they should be considered as really one layer 60 cm. thick. The two layers may possibly be accounted for by the condition of the ground when they were deposited, particularly as it has not been possible to distinguish any real difference between their contents. Both contain sherds of the Wavy Line pottery typical of the early settlement; the sherds in the lower layer are water-worn and definitely larger than those in the other; and *Limicolaria* has only been distinguished in the upper layer, the presence of whole shells indicating that this snail was living at Khartoum when this layer was deposited.

The explanation of these two layers seems most probably to be that the lower one was deposited during the earlier stages of the settlement, when this was the true flood plain, and anything deposited on it between high and low Nile was submerged under the river for part of the year; hence the sherds are markedly water-worn, there are no visible bone or shell fragments because they rotted or were carried away by the water, and the soil is black with tiny fragments of bone and other organic matter from the settlement. Subsequently the river level seems to have fallen, and at high Nile it probably

[1] Analysis: S.G. 2 per cent.; C.S. 48 per cent.; F.S. 32 per cent.; silt 3 per cent.; clay 15 per cent.; salts 0·143 per cent.

never reached M 29–36; thus the top layer contains fragments of pottery that are not water-worn although with some deposit of kankar on them, and the shell fragments in this layer are mostly of the land snail *Limicolaria*, with complete shells occurring, while such shells lying on the surface would not survive a flooding by high Nile. In fact in this area the deposition of the sand by wind and rain, which was to bury these occupation layers in M 36 under 2 m. of almost barren brown sand between then and the present day, must have begun.

The deposits below those containing occupation debris

In the hope that light might be thrown on the climate at the time of the early settlement or even before it, attention was paid, as far as the means at our disposal would permit, to the deposits below the lowest that contained debris from human habitation, and the Government Geologist and the Chief Chemist, Research Division, of the Agriculture and Forests Department, were called in to help with the interpretation.

A pit was dug to a depth of 4 m. below the occupation layer in square M 17 at the centre of the mound. The section of this pit is shown on Pl. 6.

Samples were taken at R.L. 380·30 m. of the layer underlying the lowest that contained occupation debris in square M 21, and similarly in M 25 at R.L. 380·25 m.

In square M 31 a pit was dug down to R.L. 377·0 m., about 1·5 m. below the last trace of occupation debris. In this square at about R.L. 378·65 to 378·85 m. there was a marked white band of kankar broken up by a number of vertical fissures containing deposit of the same colour and apparently of the same composition as the black clay-bonded sand containing occupation debris that overlay it (see Pl. 2, Fig. 4). In this white band at one place was a small pocket of black soil containing sherds, and close below one of the black fissures was a sandstone grinder, suggesting that it might at some time have fallen down the fissure from the occupation layer above.

Squares M 30–28 were deepened (as shown on Pl. 5) to expose the continuation of this white kankar layer, which was found to change rapidly to a layer of clayey sand plentifully speckled with small kankar concretions, between R.L. 378·90 and 378·70 m. below peg M 28. The squares north of M 31 were deepened with similar intent, and in M 32 the white band was found to be very similar to what it was in M 31, while in M 33 there were fewer and broader fissures containing black soil, one of the fissures containing a fragment of sandstone that had presumably fallen down it from the layer above that contained occupation debris. By M 34 the last fissure occurred, and the white band had changed again to a speckled layer of clay-bonded sand containing numerous small kankar concretions. This layer dipped gradually northwards. At peg M 36 it was between R.L. 376·59 and 377·40 m.

At the bottom of square M 36 another pit was dug. The section in this pit is shown on Pl. 6. See also Pl. 2, Fig. 5. Below peg M 37 the layer of grey sand speckled with kankar had fallen to between R.L. 376·30 and 376·50 m., and there was a thin layer of coarse grit at the bottom of it, where it was underlain by a marked white band at the top of nearly 2 m. of heavy blackish cracking clay, containing kankar concretions throughout, although they became less visible as the bottom was approached. This clay appeared possibly to be akin to that of the Gezira (see below). In this cracking clay were a few deep pockets of coarse sand, which appeared to have fallen down cracks that had occurred when the clay was dry. Under the cracking clay was a silt-like layer, described from the sample as greyish-buff sandy clay, the depth of which was not determined.

To the archaeologist the chief problem disclosed by this examination of the deposits below any trace of occupation debris was to interpret the story told by the phases of kankar deposition, which appeared to change rapidly, almost from square to square; for this deposition had resulted in the fossilization of human bones and the calcretion of pockets of occupation debris containing sherds,

bone, and stone artifacts at R.L. 382 m. and above at the time of the early human settlement, while the bones of people (Meroitic and later) buried in the same mound during the last 2,000 years at R.L. 381 m. had had no appreciable kankar deposited on them.

Small loosely calcreted aggregates of sand were found as high as R.L. 382 m. in the loose buff sand underlying sand containing occupation debris in squares M 19 to M 21. Really firm silt-cemented sand did not occur south of squares M–P 22, and in this sand in those squares small kankar nodules visible to the eye were plentiful and evenly distributed.

After discussing the evidence on the site with the Government Geologist (Mr. G. Andrew), the Chief Chemist (Dr. H. Greene, M.C.), and the then Deputy Director of the Agriculture and Forests Department (Mr. now Dr. J. Smith) it seems that the concretionary kankar disseminated as white or pale grey or creamy spots, irregular rounded masses or beds in the sandy deposits, is due to the usual precipitation at or above the upper limit of the fluctuation of a water-table. This water-table was probably not maintained at one level throughout the post-depositional history of these sediments, but took a number of different levels at different stages. The rounded black nodules found in sandy deposits are probably derived from heavy clays and are part of the sediment, i.e. travelled pebbles, since black kankar is so far known only to be formed in the heavy clays. The level of the water-table must have been controlled by the river (Blue Nile), and whatever climatic changes may have occurred, the precipitation of soluble salts (e.g. $CaCO_3$) must have taken place during the dry season of the year. Therefore the calcretion of the human bones and pockets of occupation debris including sherds, stone implements, &c., above R.L. 382 m. is an indication of a raised water-table, which depended primarily on the river level (at the high flood stage) irrespective of whether the rainfall was considerable or not.

By Meroitic times (*c.* A.D. 50–150) the water-table had ceased to reach R.L. 381 m., the depth of graves then dug in the mound.

In this connexion the evidence from square M 17 of a flood which reached at least R.L. 381·41 m. may be recalled. This flood occurred after the foundation of the settlement, for sherds and other debris were found in the same animal burrows as the clay left behind by the flood.

I am indebted to Mr. E. S. Waller, M.C., of the Egyptian Irrigation Service for the following information as to the highest recorded recent Nile floods at Khartoum:

1874 . . .	R.L. 377·26 m.
1878 . . .	377·57 m.
1917 . . .	376·83 m.
1946 . . .	377·14 m.

It seems therefore to be established that at the time of the early settlement the Nile was at least four metres higher than it is to-day at high-flood level.

The diagnosis of the bank of the high river at the time of the settlement in squares M 25–R 26 at about R.L. 381 m. has already been mentioned on pp. 6–7. This diagnosis receives some confirmation from the discovery of complete shells of the freshwater molluscs *Ampullaria wernei* Phil. and *Cleopatra bulimoides* Oliv. in clay where they had obviously been living at approximately R.L. 377·5 m. in square M 31, i.e. below the old river-bank, while the shells of the small land mollusc *Zootecus insularis* Ehrn. were frequent in the loose fine buff sand which underlay the sand containing occupation debris in squares M 16–21, above the old river-bank. Fragments of *Ampullaria* shell that were also found occasionally in the loose buff sand may be accounted for by wind action, which presumably blew them together with the sand grains out of the river-bed. Nothing like a complete shell of *Ampullaria* was found in this sand.

Part of a ferricrete sandstone grinder to which parts of the shells of several immature Nile oysters

(*Aetheria elliptica* Lam.) were attached was found in square K 26, and a fragment of ferricrete conglomerate with a part of a larger Nile oyster similarly attached was found in M 25, both in the vicinity of what must have been the bank of the river at high Nile. Since both these stones must originally have been brought to the site by human agency, what is known of the habits of the Nile

TABLE OF SOIL SAMPLES FROM THE EXCAVATIONS

		R.L. (m.)	Geological Survey No.		Mechanical analysis S.G.	C.S.	F.S.	Silt	Clay	Remarks
M 17	Base of pit −310 cm.	379·93	9672 *a*	Fine buff sand	1	62	33	1	3	..
	−250 cm.	379·33	*b*	Fine buff sand, irregular 20-mm. concretions	..	54	40	2	4	Same type as 9672 *a*.
	−200 cm.	378·83	*c*	Fine buff sand, irregular 30-mm. concretions	2	27	60	2	9	Small rolled fragments of calcareous grit.
	−150 cm.	378·33	*d*	Fine buff sand	..	20	71	2	7	Bone fragments.
	−100 cm.	377·83	*e*	Fine buff sand, slightly clay-bonded, concretions angular	4	41	47	1	7	..
	−50 cm.	377·33	*f*	Fine buff clayey sand, 40-mm. concretions	1	13	63	3	20	..
	Base of pit	376·83	*g*	Darkish-buff clayey sand with spots of kankar	1	23	43	7	26	..
			(From 9672 *a–e* concretions friable)							
M 21	*Jebel*	380·30	9673	Fine buff sand, concretions friable	..	72	22	1	5	Same type as 9672 *a* and *b*.
M 25	*Jebel*	380·25	9674	Fine brownish-buff clayey sand	..	45	38	6	11	..
M 28	Base of trench −90 cm.	379·30	9675 *a*	Fine brownish-buff clayey sand	..	61	26	2	11	Bone and *Ampullaria* fragments.
	−50 cm.	378·90	*b*	Fine brownish-buff clayey sand, concretions	..	52	31	2	15	Bone fragments.
	−25 cm.	378·65	*d*	Greyish-buff clayey sand, concretions	2	35	28	14	21	Shell fragments.
	−20 cm.	378·60	*c*	Greyish-buff clayey sand	..	27	40	6	26	..
			(Concretions small, white, and firm in 9675 *b–d*)							
M 31	Base of trench −230 cm.	379·10	9676 *a*	Black clay-bonded sand, no concretions	1	48	32	5	14	Bone and other organic fragments.
	−180 cm.	378·72	*b*	Pale grey-and-white sandy kankar	3	28	24	26	19	Bone fragments.
	−150 cm.	378·42	*c*	Dark-grey sandy clay, concretions	3	8	38	18	34	,, ,,
	−100 cm.	377·92	*d*	Dark-grey sandy clay, concretions	2	3	33	23	39	..
	Top of trench −400 cm.	377·47	*f*	Dark-grey sandy clay, concretions	5	7	47	15	26	..
	Base of trench	377·07	*e*	Brownish-buff clayey sand, concretions	1	19	65	5	10	Bone fragments.
			(Concretions in 9676 *c–f* are firm, white, and irregular)							
M 33	Base of trench −300 cm.	378·30	9677	Brown clay-bonded sand, friable spots of kankar	..	64	22	2	12	Bone fragments: high proportion of rounded sand grains.
M 35	Top of trench −150 cm.	379·49	9678 *a*	Brown sand, little clay, no concretions	..	65	26	1	8	Bone and shell fragments.
	−200 cm.	378·99	*b*	Dark-grey sand, little clay, no concretions	..	55	33	2	10	,, ,, ,,
	Base of trench −50 cm.	377·56	*c*	Light-grey sand, little clay, white concretions	..	41	45	2	12	..
	−10 cm.	377·20	*d*	Light grey-buff clay-bonded sand, diffuse spots of kankar	..	51	35	2	13	..
M 36 (north end)	Base of pit −400 cm.	378·38	9679 *a*	Black sand, no concretions	1.	60	26	4	9	Bone and shell fragments.
	−350 cm.	377·88	*b*	Dark-grey clay-bonded sand, no concretions	..	65	17	2	17	Bone fragments.
	−300 cm.	377·38	*c*	Dark greyish-buff clay-bonded sand, small diffuse spots of kankar	..	19	63	3	15	,, ,,
	−250 cm.	376·88	*d*	Greyish-buff sand, small diffuse spots of kankar	..	40	43	3	14	..
	−200 cm.	376·38	*e*	Greyish-buff sand, abundant irregular concretionary kankar	15	69	9	1	6	Worn black kankar nodules.
	−150 cm.	375·88	*f*	Greyish-buff clayey sand, concretionary kankar	15	44	16	9	16	,, ,, ,,
	−100 cm.	375·38	*g*	Dark greyish-buff clay, concretionary kankar	7	22	17	15	39	Bone fragments.
	−50 cm.	374·88	*h*	Dark greyish-buff clay, concretionary kankar	2	9	36	2	51	Kankar *in situ*.
	Base of pit	374·38	*i*	Greyish-buff sandy clay, irregular concretionary kankar	13	12	24	19	32	,, ,,

S.G. = stones and gravels over 2 mm. C.S. = coarse sand, 0·2 to 2·0 mm. F.S. = fine sand, 0·02 to 0·2 mm. Silt = 0·002 to 0·02 mm. Clay = below 0·002 mm.

Note: All specimens, except where otherwise stated, contained disseminated calcium carbonate and kankar concretions, some more or less friable, some ill defined and spongy, some compact. In addition there were transported pebbles and grains of kankar in the sediments where stated in the 'Remarks' column. Rounded black kankar nodules, such as might be derived from the Gezira clay, appear in all samples except 9676 *a* and *b*, 9678 *b–d*, and 9679 *a–d*.

oyster suggests that the river may have maintained high level long enough for the oysters to become attached to these stones. This in turn suggests that the peak of the flood was of longer duration at the time of the early settlement than is the case to-day. But of course the stones may have been brought by inhabitants of the settlement to where they were found from low-river level farther north, after the shells had attached themselves, although why this should have been done is not obvious, and if the stones had been re-used, traces of the oyster shell would have disappeared.

The fissures in the white layer at about R.L. 378·5 m. in squares M 31–4 were so arranged—with the thinner and most frequent fissures farthest from the river—that the natural interpretation seemed at first to be that they were due to trees, probably *sunt* (*Acacia nilotica*), which had been growing, as *sunt* trees do to-day, on the river-bank just above and even just below high-flood level, but after discussion on the spot with Dr. H. Greene, who has had much experience of cracked clay soils in the Gezira area south of Khartoum, it seems more probable that the fissures were cracks in the soil. They occur in square M 31 in a deposit, a sample of which is described as grey sandy kankar, and contains on mechanical analysis 34 per cent. clay and 38 per cent. fine sand fractions.

Soil samples were taken from the various layers as shown in the table on p. 13. They were sent to the Chief Chemist for mechanical analysis, and then examined petrologically by the Government Geologist, who reports that they can all be identified as Blue Nile sediments from the occurrence of purple basaltic pyroxene and plagioclase and occasional zeolites. He also states that all minerals indicate a climate generally arid, with rapid transport of the minerals from their place of origin, and burial on the site soon after arrival.

With regard to the clay layer from R.L. 374·50–376·0 m. near the bottom of the pit in M 36 and the possibility that it might be akin to the clay of the Gezira, the Chief Chemist noted that no gypsum was seen in the separations, although lenticular gypsum is typical of the Gezira subsoil; and he therefore considered the evidence negative as to this clay being akin to the Gezira soil, even though black calcareous nodules are fairly prominent and the clay content reasonably high. On this the Government Geologist commented that the absence of gypsum might mean that these clays are redeposited Gezira clays, from which the gypsum had been removed by solution during transport down-stream from their original place of deposition. The kankar nodules often exhibit a worn pellicle of black oxide, due to abrasion during transport, but they are not removed in solution owing to the lower solubility of $CaCO_3$.

R. L.

383 m.

M 10 | M 11 | M 12 | M 13 | M 14 | M 15 | M 16 | M 17

382

381

380

Loose grey sand containing occupation debris

Loose grey sand containing some occupation debris

Buff sand with pockets of grey debris. Few friable concretions

Fine buff sand

Grave

Burial M. 15 (5)

Grave

Grey sand containing occupation debris

S

Two Graves

clay

Buff sand with few friable concretions of Kankar and veins of grey water-laid clay, some occupation debris

Fine buff sand

Pit

383 m.

M 23 | M 24 | M 25 | M 26 | M 27 | M 28 | M 29 | M 30

382

381

380

379

378

377

376

Grey-buff sand with some occupation debris

Grave

Grave

Grave

Grave

Grave

Grave

Grave

Grave

Grey clay-cemented sand containing many fragments of Ampullaria shells and some other occupation debris

Grey clay-cemented sand containing some occupation debris

Fine brownish-buff clayey sand

Brownish-buff clayey sand

Much ampullaria shell

clay-bonded black sand containing much occupation debris

S

Brownish-buff clayey sand without concretions

Brownish-buff clayey sand with concretions of kankar

Greyish-buff clayey sand with concretions of Kankar

White

Greyish-buff clayey sand

NORTH-SOUTH SECTION. WEST SIDE OF STRIP M.

Scale

0 4 8 Metres

KEY

- Barren drift sand
- Area disturbed or apparently disturbed since the occupation.
- Animal burrow (Shapes vary).
- Limit of excavation
- S Complete Limicolaria shell
- Ampullaria shell fragments
- Potsherd
- Stone

M 14 M 15 M 16 M 17 M 18 M 19 M 20 M 21 M 22

Grave
Burial M. 15 (5)
Grave
Grey sand containing occupation debris
Two Graves
clay
Disturbed
Grave
Burial M. 19 (6) Meroitic
Grey sand with occupation debris
Disturbed
Buff sand with few friable concretions of Kankar and veins of grey water-laid clay, some occupation debris
Greyish buff clay-cemented sand with some occupation debris
Fine buff sand
Pit
Fine buff sand with friable concretions of Kankar (occupation debris only in animal burrows)
Zootecus shells throughout

M 27 M 28 M 29 M 30 M 31 M 32 M 33 M 34 M 35

Grave
Grave
Grave
Grave
Grave
Grave
Grave
Grave
of Ampullaria shells
Much ampullaria shell
clay-bonded black sand containing much occupation debris
Brown sand slightly clay-bonded
Brownish-buff clayey sand without concretions
Bone
Black clay-bonded sand
Brownish-buff clayey sand with concretions of kankar
Greyish-buff clayey sand with concretions of Kankar
Greyish-buff clayey sand
White kankar horizon
White kankar horizon
Grey-and-white sandy Kankar
Hard black sand
Dark grey sandy clay with Kankar concretions
Ampullaria and Cleopatra shells
White kankar horizon
Brownish-buff clayey sand with concretions

R.L.

M 18 | M 19 | M 20 | M 21 | M 22 | M 23 | M 24

383 m.

382

381

380

Disturbed

Grave

Burial M.19 (6) Meroitic

Grey sand with occupation debris

Disturbed

Buff sand with some occupation debris (presumably disturbed)

Grey-buff sand with some occupation debris

Grave

Greyish buff clay-cemented sand with some occupation debris

Fine buff sand with friable concretions of Kankar (occupation debris only in animal burrows)

Zootecus shells throughout

Grey clay-cemented sand containing some occupation debris

M 31 | M 32 | M 33 | M 34 | M 35 | M 36 | M 37

383 m.

382

381

380

379

378

377

376

Grave

Grave

Brown sand slightly clay-bonded

Grave

Bone

Black clay-bonded sand

Brown sand slightly clay-bonded

Hard black sand

White kankar horizon

Grey-and-white sandy Kankar

Dark grey sandy clay with Kankar concretions

Ampullaria and Cleopatra shells

Brownish-buff clayey sand with concretions

White kankar horizon

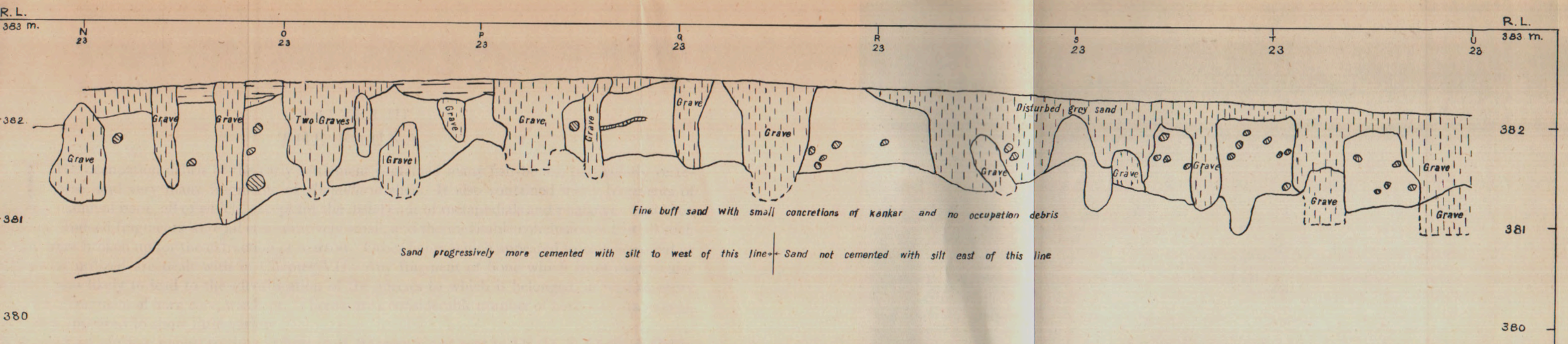
Dark grey clay-bonded sand

Greyish-buff clay-bonded sand speckled with kankar

Grey clay-bonded sand with few spots of Kankar

Greyish-buff clay-bonded sand

Pit



SECTION E-W. STRIP 22

KEY

Barren drift sand

Area disturbed or apparently disturbed since the occupation

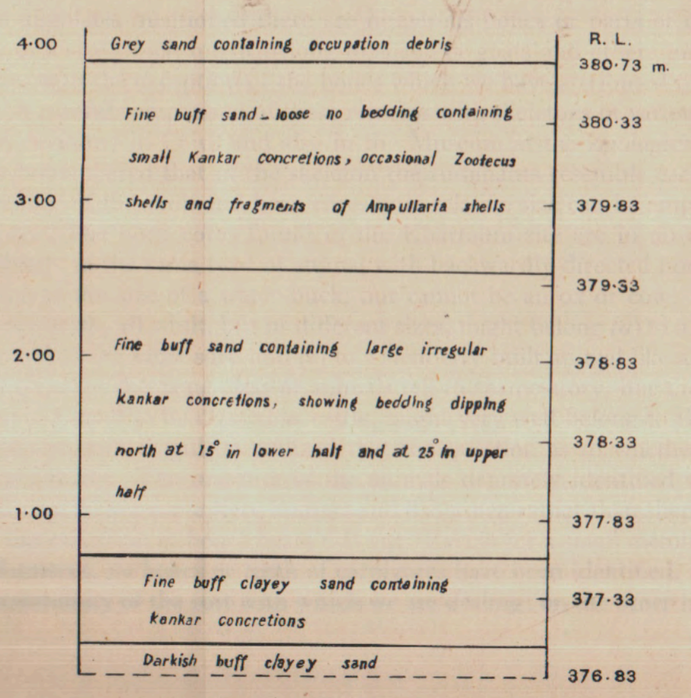
Animal burrow

Limit of excavation

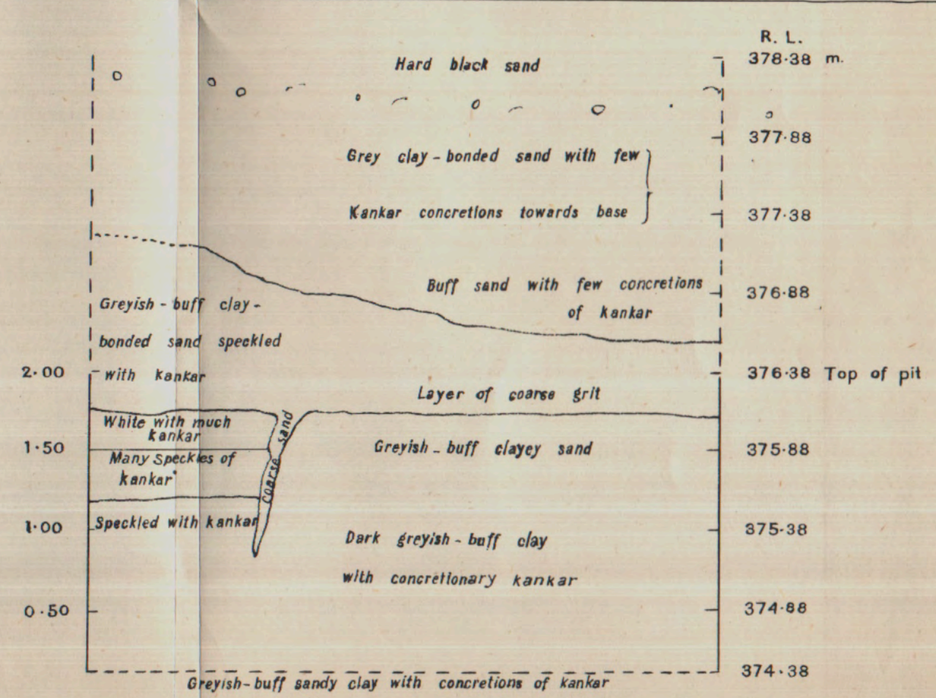
Unshaded areas above base line are of grey sand containing occupation debris and not recently disturbed.

Scale

0 4 8 Metres



SECTION OF PIT IN SQUARE M 17



SECTION OF PIT IN SQUARE M 36

CHAPTER III
THE FAUNA

THE occupation debris of the early settlement contained many fish-bones, particularly vertebrae, and very many fragments of *Ampullaria* shell. It also contained many fragments of mammal bone, all of which, except for the distal ends of metapodials and phalanges, had been broken. Indeed fragments were all comparatively small, and the inevitable conclusion is that all such bones were broken up for the extraction of marrow. Other bones which appeared to have been cut or otherwise utilized are dealt with in Chapter VII. Any fragment of bone which from its articular surface was likely to lead to the identification of the species to which it belonged, as well as every tooth and fragment of horn core, was kept. There were a considerable number of horn-core fragments, but they appeared to show little variety.

A selection of these bones, teeth, and horn-core fragments was sent to Dr. D. E. Derry at Cairo, with the request that he should identify as many as possible, and particularly keep a look-out for animals that might have been domesticated.

Dr. Derry reported as follows:

'ANIMAL BONES FROM EARLY SITE IN KHARTOUM

'The following animals have been identified either by bones or teeth or both, from the remains brought to light during the progress of the work on the above site:

Crocodile
Porcupine
Hippopotamus
Wart-hog
Buffalo.

In addition to the ungulates mentioned there are numerous bones or parts of bones of ruminants. Some of these are of a size which might belong to sheep or goats and others to larger animals such as antelopes. None, with the exception of the bones which we have attributed to a buffalo, could be ascribed to cattle. A careful comparison of these remains with skeletons of various animals preserved in the Museum of Anatomy in Cairo and also in the Museum at the Zoological Gardens has been made. It must be remembered that in the skeleton the ruminants resemble each other very closely and that in the absence of the skull and horn cores only relative size can be employed as a means of differential diagnosis. The horn cores found in the Khartoum site are in no case those of cattle. Three belong definitely to the same type of animal with backwardly directed horns, which might be those of an antelope of the size of a water-buck, but cannot be an ox or cow. Fragments of three mandibles containing teeth, all adult, but of different sizes, might belong (*a*) to a large sheep or goat, (*b*) to a smaller animal of the same sort, and (*c*) to a slenderly built animal like a gazelle. Numerous fragments of limb bones of the same class of animals tell the same story, but there are also remains which, while being too small to be classed as cattle, might very well belong to the larger antelopes.

'From what has been said it will be realized that the question as to whether these people kept domestic animals is difficult. The presence of the animals definitely identified would seem to support the suggestion that these people were hunters and fishermen rather than shepherds. The heterogeneous nature of the collection of bones bears this out. Except for a small member of the cat family, represented by a humerus, no bones or teeth of carnivores have been identified. This is what might be expected in a community of the sort with which we are dealing: on the other hand, if these people

had kept cattle or sheep and goats one might very well have met with bones of hyena. Even to-day this animal is trapped in pits dug by the natives at the entrance to the zareebas where the goats and sheep are kept at night. The only trace of what may be hyena is found in the gnawed human femur N 20 (2), which had probably been exhumed by the animal while still relatively fresh. It was subsequently mineralized in company with the rest of the bones from the early site.'

A further large quantity of animal remains having been obtained subsequently to Dr. Derry's report, the whole collection was forwarded to the British Museum (Natural History), and the following report was sent by Dorothea M. A. Bate.

'THE VERTEBRATE FAUNA

'During the excavation of the early levels of the Khartoum site a large quantity of animal remains, amounting to several thousands of specimens, was collected. These are of great interest and importance, since they throw light on several aspects of life and conditions in those early days. Perhaps the most obvious is that from the nature of the remains the food of these early settlers is known, and something of their habits suggested, of how they procured food and whether this was obtained on the spot, or sought by hunting far afield. Also did they keep domestic animals? A question of almost equal interest is of what animals was the fauna of that day composed? Are they the same as are found in this area to-day, are they similar to the species found in the southern Sudan, or do they represent a different and perhaps extinct fauna? The answers to these questions are tied up with those of environmental and climatic conditions, with possible records of significant changes. Yet another problem encountered is whether the fauna gives any information regarding the actual age of the deposit, or concerning faunal interrelationships with other parts of Africa. It is hoped to answer a few of these questions in the Summary (p. 27), but first a brief description of the collection and of the species which comprise the fauna will be given.

'All the animal remains are covered with a thin, hard, and strongly adherent calcareous deposit. With few exceptions all the bones in the collection are broken, a condition obviously due to the animals having been used for food. This, unfortunately, has made it impossible, except in one case, to make specific determinations. There is no sign of longitudinal breaking of long bones for the extraction of marrow, but this might perhaps have been obtained by ordinary transverse breaking. In this connexion it may be mentioned that the distal ends of metapodials of antelopes are specially numerous. Only a very few bones bear evidence of the action of fire, so few in fact that this condition may have been accidental. Another point of interest is that, although there are a few remains of young or immature animals, for instance the milk dentition of a Wart-hog, such specimens are rare. This is no doubt an argument against the presence of domesticated animals.

'FISH

'The fish remains include a very large quantity of bones, totalling a greater number than those of any other group of vertebrates preserved in the collection. The specimens, chiefly vertebrae, spines, and skull bones, are generally fragmentary, thus precluding the possibility of making definite specific determinations. Dr. Ethelwyn Trewavas has kindly examined the remains and given me the following information. Eight genera are represented, and these are still commonly found living in the Nile. There seems also to be nothing to suggest the presence of any species other than those occurring at the present day.

'Remains of various Catfishes, especially *Clarias* (Mud-fish), are the most abundant, and their pectoral spines are numerous. Usually the distal portions of these spines, and those of other Catfish,

are broken off, the tips being removed owing to their poisonous nature, while, as described elsewhere, the central portion was commonly used by the early inhabitants of the site for incising decorative patterns on their pottery.

'The following is a list of the forms represented:

1. *Polypterus* sp.

'An air-breathing fish, possibly the one known to-day as *ab sheer*. A number of scales and some vertebrae are present.

2. *Labeo* sp.

'Represented by vertebrae.

3. *Clarias* sp.

'Including *C. lazera*. There are numerous remains of this and members of the two following genera of Catfish.

4. *Synodontis* sp.

5. *Clarotes* sp.

6. *Lates* cf. *niloticus* (Linnaeus).

'Remains of the Nile Perch are not uncommon, and include vertebrae and fin spines.

7. *Tilapia* sp.

'There are a number of vertebrae of this fish, forms of which inhabit many of the rivers and lakes of Africa, and which are commonly used for food to-day.

8. *Hydrocyon forskàlii* Cuv.

'About a dozen teeth of Tiger fish match very well those in the skull of a large specimen in the British Museum collection.

'Besides the above, Mr. Arkell has distinguished spines of *Bagrus* sp.

'REPTILES

'With the exception of *Trionyx* remains of reptiles are comparatively rare in the collection, and they are not sufficiently complete to admit of specific identification. Dr. W. E. Swinton has very kindly examined the specimens, and reports that bones of four genera are present.

Crocodilus sp.

'Only a few fragments of jaws and a number of dermal scutes are preserved, and it seems probable from the rarity of its remains that this animal was not used for food.

Python sp.

'About two dozen vertebrae of python are present, a few of these are of large size, representing an animal about 10 ft. in length. Jackson (1923) states that the Python is the only snake eaten by Nilotes to-day. It is also of interest that this snake will prey on Reed Rats.

'Besides the above-mentioned specimens are a number of python vertebrae which have been artificially reduced to a uniform contour by the rubbing away of the different processes, to form an ornament, possibly an armlet, for human use. These interesting specimens, which were found apparently lying in a coiled position, have been described and figured in Chapter V (pp. 39–40 and Fig. 5). At the present day somewhat similar strings of vertebrae are worn round the waist, other waistlets being made of vertebrae of *Varanus* (Jackson, 1923, p. 133).

Varanus sp.

'The collection includes eight fragments of jaws and about two dozen vertebrae of a species of Monitor. There are a number of species of these lizards, some of which are almost entirely aquatic in their habits.

Trionyx sp.

'A considerable number of fragments of the carapace and plastron of the River Turtle are present, but none are sufficiently complete to indicate the size or other details of any individual specimen.

Testudo spp.

'Tortoises of two different sizes are represented, one by fragments of carapace, the other by a humerus only 27 mm. in length.

'BIRDS

'It is curious that in this huge collection of animal remains only three isolated bones of birds are present. It may be that these were not easily caught, or that there was little incentive for special effort where alternative and more substantial game was abundant. The absence of fragments of ostrich egg-shell is likewise noticeable; either these birds did not live in the vicinity, or mammalian meat and fish were preferred exclusively.

'One of the bird bones preserved is the distal end of a humerus of an anatine bird which resembles closely in size and shape this bone in the Spur-winged Goose, *Plectropterus gambensis* (Linn.), of which various races occur over the greater part of Africa to-day. The other two bones have not yet been identified.

'MAMMALS

'The following is a list of the species present:

1. *Hyaena* cf. *hyaena*	Hyena.
2. *Canis* ? *lupaster*	? Egyptian Wolf-jackal.
3. *Atilax* cf. *paludinosus*	? Water Mongoose.
4. *Mungos* sp.	Mongoose.
5. *Panthera* cf. *pardus*	? Leopard.
6. *Felis* sp. (cf. *ocreata*)	Wild Cat (large).
7. *Hystrix* sp.	Porcupine.
8. *Thryonomys arkelli*	Arkell's Reed Rat.
9. *Rattus* (*Mastomys*) cf. *coucha*	? White-nosed Rat.
10. *Arvicanthis* sp.	Spiny Field Rat.
11. *Hippopotamus* cf. *amphibius*	Hippopotamus.
12. *Phacochoerus* sp.	Wart-hog.
13. *Onotragus* cf. *megaceros*	? Nile Lechwe (Mrs. Gray's Cob).
14. ? *Adenota leucotis*	? White-eared Cob.
15. *Antilope* sp. (large)	Antelope.
16. *Antilope* sp.	Antelope.
17. ? *Ourebia* sp.	? Oribi.
18. *Antilope* sp. (another small sp.)	Small Antelope.
19. *Syncerus* cf. *aequinoctialis*	? North-eastern Buffalo.
20. *Equus* sp.	Equine.
21. *Diceros* cf. *bicornis*	? Black Rhinoceros.
22. *Loxodonta* cf. *africanus*	? African Elephant.

'The above list is quite a long one, but it has to be remembered that a number of animals are represented by perhaps a single bone or tooth; for instance, remains of carnivora are noticeably scarce, and of each of the three larger species in the list, *Hyaena*, *Canis*, and *Panthera*, there is only a single or at most two teeth. In only a single case, that of *T. arkelli*, has it been possible to make a definite specific determination.

'Antelopes are represented by a much larger number of both species and specimens than is any other group. Other than the antelopes, buffalo remains are more plentiful than those of other species.

'The following are brief notes on the mammals included in the collection:

Hyaena cf. *hyaena* (Linnaeus). Hyena.

'The presence of hyena is shown by the crown of a single carnassial tooth which is much smaller than that of *Crocuta crocuta* (the spotted hyena), and resembles in size and other characters that of *H. hyaena*. To-day both species are found fairly widely distributed throughout the Sudan, though the larger *C. crocuta* is the commoner of the two. This species as well as other larger carnivora is no guide to environmental conditions since their presence is governed by that of suitable prey.

Canis cf. *lupaster* Hempr. and Ehrenberg. ? Wolf-jackal.

'The collection includes two right upper incisors in a fragment of the premaxilla which differ from those of *Lycaon* and are much bigger than those of the jackals; they resemble very closely both in size and shape those of *C. lupaster*, the Wolf-jackal of Egypt. The specimen is not sufficient to make the occurrence of this species quite certain, but should this identification be confirmed later it will be of some interest, since this animal is not nowadays found so far south as Khartoum. Major Stanley Flower (1932), who knew the Wolf-jackal well, says that its southern limit is the El Derr district of Aswan Province, Upper Egypt. However, he goes on to say that he was uncertain about its occurrence in Wadi Halfa Province.

Atilax cf. *paludinosus* (Geoff. and Cuvier). ? Water Mongoose.

'There are portions of four mandibular rami which between them show examples of each of the lower cheek teeth. These specimens resemble very closely Recent examples of this species with which they have been compared.

'The Water Mongoose is an aquatic animal, and is never found far from water: it is an inveterate enemy of the Reed Rat. Fitzsimons (1919, ii, p. 26) says that it is common throughout South Africa, and its range extends north as far as the Equator. I do not know if it has been recorded from the Sudan.

Mungos sp. Mongoose.

'Two maxillae with teeth of a mungotine are smaller than those of *Atilax paludinosus*, and about the size of those of *Suricata*. These two specimens have been compared with a large number of species in the British Museum collection, but it has not been possible to identify them specifically, and it seems possible that they may represent an extinct form.

'These animals are very generally distributed in Africa and southern Asia, and are also found in southern Europe.

Cf. *Panthera pardus* (Linnaeus). ? Leopard.

'A single imperfect carnassial tooth closely resembles that of a Recent leopard.

Felis sp. (cf. *ocreata*). Wild Cat (large).

'There are several typical limb-bones of a cat considerably larger than a European Wild Cat, but there is not sufficient material to hazard a specific determination, and the above name is mentioned only as a tentative indication of size.

Hystrix sp. Porcupine.

'There are several portions of lower jaws with teeth, as well as a few isolated teeth and a tibia, which show that they represent a true Porcupine. The specimens are, however, not sufficiently complete for it to be possible to determine to which of the two groups, into which the African true Porcupines are separated, they should be referred.

Thryonomys arkelli Bate. Arkell's Reed Rat.

'This is the most interesting species included in the collection, and the important zoological,

geographical, and other data which it provides will be noted later. This Reed Rat has proved to be a hitherto unknown and extinct species, and a description of the remains has lately been published in

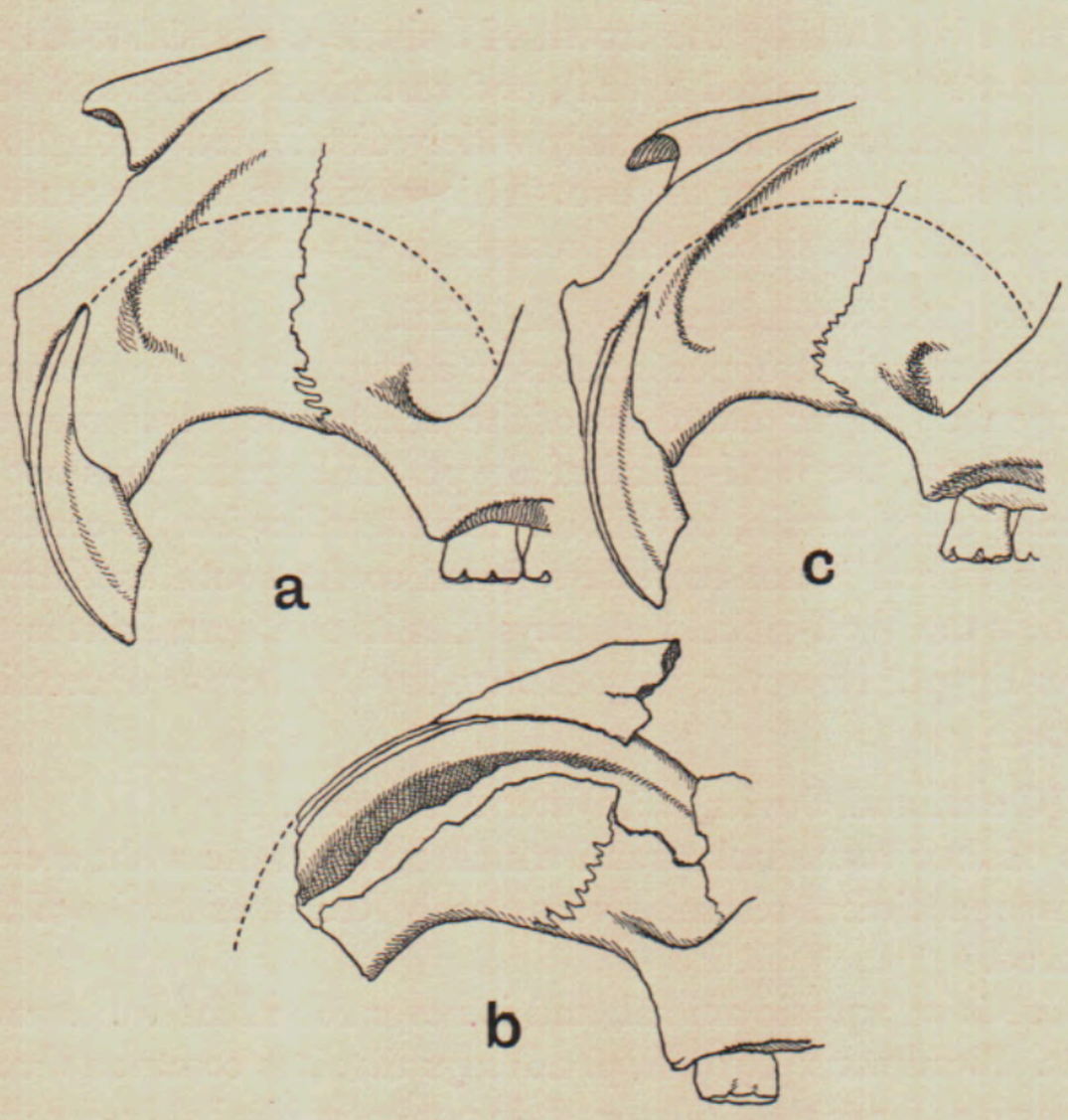


FIG. 1. Lateral view of anterior portion of skull of (*a*) *Thryonomys swinderianus*, Recent, from Sierra Leone; (*b*) *T. arkelli*, holotype, from early settlement, Khartoum; (*c*) *T.* (*Choeromys*) *harrisoni*, Recent, from Lado District, Sudan. All figures $\times 2\frac{1}{2}$.

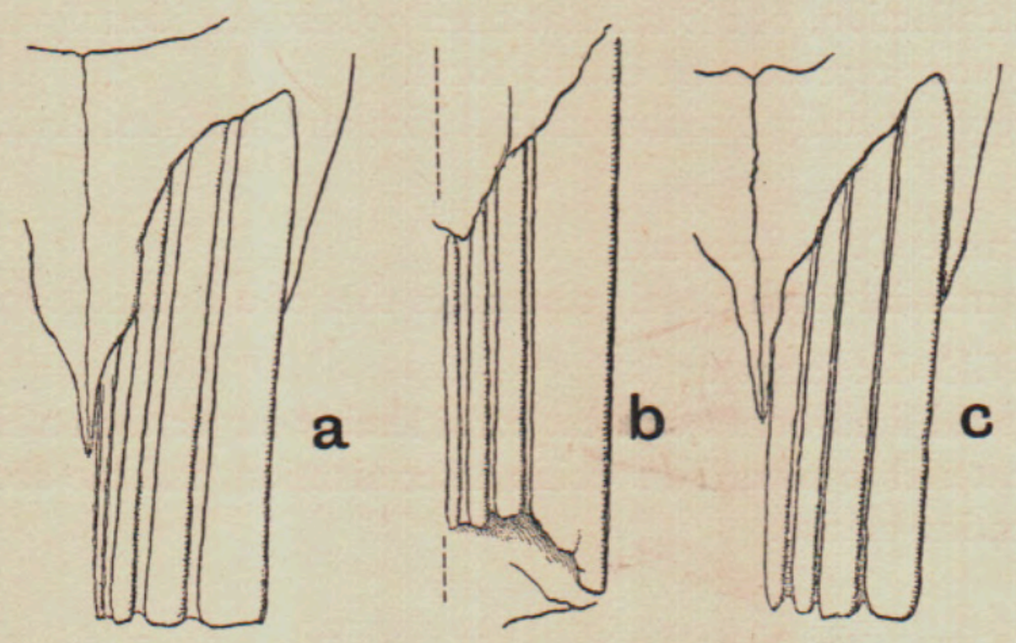


FIG. 2. Anterior aspect of left upper incisor of (*a*) *Thryonomys swinderianus*, Recent; (*b*) *T. arkelli* holotype; (*c*) *T. harrisoni*, Recent. From the same specimens as shown in Fig. 1. All figures $\times 2\frac{1}{2}$.

Annals and Magazine of Natural History (Bate, 1947), to whose Editors I am indebted for permission to reproduce some of the text, together with the drawings (Figs. 1 and 2).

'*Diagnosis*. A *Thryonomys* belonging to the *T. swinderianus* group, slightly larger than Recent

species. Snout longer, with incisors having a more open curve than in Recent species; anterior palatine foramina long, penetrating well behind the premaxilla–maxilla suture as in *T. swinderianus*; a sharp bony ridge running from the antero-internal border of the alveolar cavity to the front of the anterior palatine foramen. Width of upper incisor less than in *T. swinderianus*, but with the outer segment occupying more than half the anterior surface of the tooth; innermost segment very narrow; spaces between the segments narrow, narrower than in Recent *T. swinderianus*. Cheek teeth large, M^3 erupting late.

'*Holotype*. The left half of the anterior portion of a skull, with proximal part of incisor, pm^4 and M^{1-2}. Brit. Mus. M 16339.

'Besides the holotype the collection includes a right maxilla with pm^4 and M^{1-2}, the second molar not yet in wear; also a fragment of a left maxilla with pm^4 and M^{1-2}, the three teeth slightly worn, and having an antero-posterior length of 14·4 mm., which is more than in the holotype.

'That the holotype skull of *T. arkelli* represents a sub-adult animal is suggested by the fact that, although the second molar is already somewhat worn, there is only a vestige of the last molar embedded in the alveolus. The late eruption of this tooth is evident in a number of Recent specimens examined, and is characteristic of the genus. The three cheek teeth, pm^4, M^{1-2}, have an antero-posterior length of 13·4 mm., and M^2 a width of 6·7 mm. The corresponding measurements in a fully adult *T. swinderianus* with the four cheek teeth in wear are similar, which, together with the still larger teeth of another specimen of *T. arkelli* already mentioned, suggests that the fossil surpasses in size the Recent species. The upper incisor in the holotype of *T. arkelli* has a width of 5·4 mm., which is similar to that of the tooth of the smaller Recent species, *T. harrisoni*, while in an adult *T. swinderianus* this measurement is 6·4 mm. The upper incisor of the fossil, however, resembles that of *T. swinderianus* in the great width of the outer segment, and in the narrowness of the innermost segment; on the other hand, it differs in having much narrower grooves, and in the noticeably lesser width of the complete tooth already referred to. While the grooves are narrow in the tooth of *T. harrisoni* (*gregorianus* group) the proportional widths of the segments differ from those of *T. arkelli*. These characters are clearly shown in Fig. 2 on p. 20.

'*Habits*. The large Reed Rats with short tails and harsh stiff fur are vegetarian in diet, and frequent reed beds, swamps, and thick jungle, readily taking to the water, being strong swimmers and divers.

'*Distribution and fossil record*. The Recent Reed or Cane Rats, *Thryonomys*, are hystricomorph rodents of rather doubtful affinity, for which the family Thryonomyidae has been instituted by Mr. Pocock (1922). They are now confined to Africa south of the Sahara, and have been separated into two groups whose distributional areas are shared in part. The *T. swinderianus* group is found in Sierra Leone, Nigeria, Angola, and across to Nyasaland and Mozambique, while the *T.* (*Choeromys*) *gregorianus* group occurs in the Lake Chad district, the southern Sudan south of Juba, central Africa, and the Belgian Congo. Rather surprisingly it is to the first-named, *T. swinderianus*, group that the Khartoum fossil is related.

'Not very much is known of the fossil record of the group. Stromer has described two genera, *Neosciuromys* (1922) and *Phiomyoides* (1926), from the Lower Miocene of south-west Africa which may perhaps be ancestral. Should this surmise be correct it might suggest an African origin for the family. Records from somewhat later times are known from the Siwaliks of India; Mr. Hinton (1933) described the small *Paraulacodus indicus* from the Upper Chinji stage as having characters showing close resemblance to the Recent *Thryonomys*. *Sayimys perplexus* from the slightly later Nagri zone has been more doubtfully referred to a later development of Stromer's *Phiomyoides humilis* from Africa (A. E. Wood, 1937).

'For the next record a return to Africa must be made, where remains representing both the *swinderianus* and *gregorianus* (*Choeromys*) groups of Reed Rat have been recorded as plentiful from Gamble's Cave II (Upper Kenya Capsian) in Kenya (Hopwood, 1931). That not so long ago the range of the genus *Thryonomys* extended much farther north than it does at present is proved, not only by the specimens in the present collection, but also by a skull and skeleton from the dry Wadi Odiemet, a tributary of the Wadi Tamanrasset (Pl. 101) described by Romer and Nesbitt (1930) as an extinct species (*T. logani*) belonging to the *T. swinderianus* group. This find was apparently associated with fossilized human remains and those of snake, buffalo, gazelle (horn cores), ostrich, &c., and may be late Pleistocene or even more recent.

'Another discovery, from Guir, in the western Sahara (Roman, 1935), from a deposit probably contemporary with the above, includes two portions of lower jaws of a *Thryonomys* said to be related to the *T. swinderianus* group. There are also human remains and bone harpoons, with bones of fish and water-loving mammals such as Hippopotamus and *Limnotragus*, the Situtunga, with its feet specialized for life in watery reed swamps. The former presence of the swamp-dwelling *Limnotragus* and of *Thryonomys*, an inhabitant of well-watered country and thick vegetation, emphasizes the great climatic changes which have taken place in both these areas and perhaps stresses the climatic connexion of the southern Sahara with the northern Sudan.

Rattus (*Mastomys*) cf. *coucha* (A. Smith). ? White-nosed Rat.

'The collection contains the left half of a mandible of a rat which evidently belongs to the *Mastomys* group. To-day the white-nosed rats are very generally distributed in southern Africa, and one or two species are found in the southern part of the Sudan. These rats are commonly found in rank grass or dense bush in the vicinity of water.

Arvicanthis sp. Spiny Field Rat.

'There are four mandibular rami of a Spiny Field Rat, but these are not sufficient to provide specific determination, though they are smaller than specimens from the Sudan with which they have been compared.

'More than one form of *Arvicanthis* is found in the southern part of the Sudan at the present day, and they are essentially inhabitants of bushy or grassy country with a plentiful supply of water.

Hippopotamus cf. *amphibius* Linnaeus. Hippopotamus.

'Remains of hippopotamus are not uncommon, and include a few isolated teeth of very large size. Individuals may still be seen in the Nile both above and below Khartoum.

Phacochoerus sp. Wart-hog.

'There are about two dozen cheek teeth or parts of teeth of Wart-hog; also a mandibular ramus retaining the milk dentition, one of the few instances of the occurrence of a juvenile animal.

Antelopes

'Remains of antelopes are more plentiful in the collection than those of any other mammals; distal ends of metapodials with the shafts broken transversely are numerous, as are also horn cores, many of which are broken, and few are attached to even a small portion of the skull. It is evident that these animals provided a not inconsiderable part of the food of the early inhabitants of the Khartoum site, but besides this their remains seem to have been also valued for other purposes. Horn cores artificially cut across transversely are present, and of particular interest are a number of distal ends of metapodials with the articular ends rubbed down to form a smooth and rounded surface. It is not possible to

identify species from metapodials, but these are all made from the bones of small antelopes, mostly about the size of *Ourebia*, with a few about the size of *Gazella soemmeringi*, which otherwise rarely occur in the collection, thus suggesting that they may have been hunted especially to put some of their bones to a particular use. For a possible use to which these worked metapodials may have been put see pp. 77–8 (Pl. 54, Figs. 4 and 5).

'Since bones and teeth of antelopes have a close family resemblance it is particularly unfortunate that the specimens in the collection are so imperfect, for this makes close identifications a matter of great difficulty. It has been possible, however, to distinguish the presence of at least six species:

Onotragus cf. *megaceros* (Fitzinger). ? Nile Lechwe (Mrs. Gray's Cob).

'Among the horn cores two at least are almost certainly those of *Onotragus*, for they are similar in size to those of a Recent example and show the typical wide spread and low backward tilt of the horns,

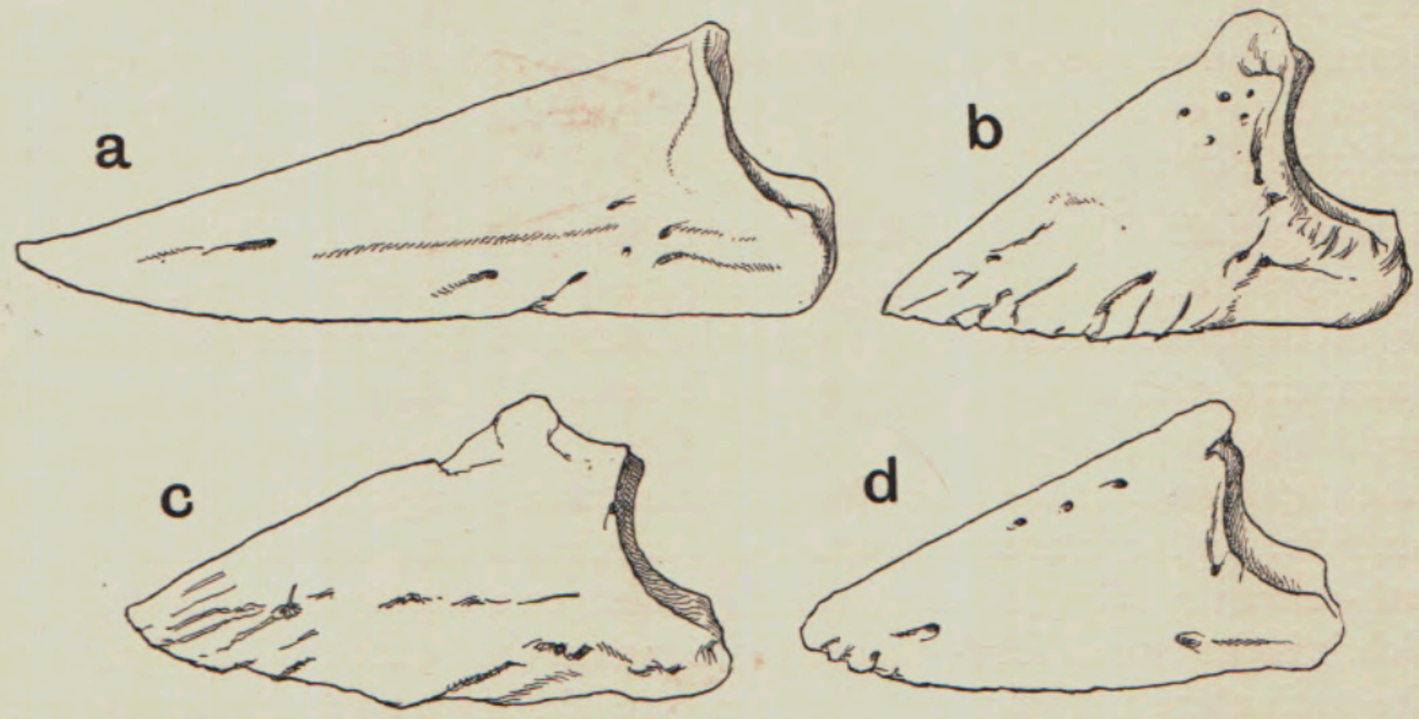


FIG. 3. Left terminal phalange of (*a*) *Limnotragus* sp., Recent; (*b*) *Cobus defassa*, Recent; (*c*) *Onotragus* sp., from early settlement, Khartoum; (*d*) *O. megaceros*, Recent. All figures natural size.

and the extreme rugose condition of the core. Besides these there are two of the distinctive distal phalanges which show a midway condition of specialization for life in swamps, between the extreme adaptation for aquatic habits developed in *Limnotragus* (the Situtunga) and the typical antelopine hoof bone such as is found in the Water-buck (*Cobus*) which, in spite of its common name, is entirely a land animal, though always found within reach of water. Drawings of these adaptive types of foot bones are shown in Fig. 3. The feet themselves have been figured by Chapman (1921, p. 152, and p. 161). Lönnberg (1929, p. 23) has published an instructive photograph of the feet of *O. megaceros* showing clearly their specialization for life in swamps. He makes the interesting suggestion that this is a secondary adaptation, for his main contention is that what are now termed the African antelopes originally came from Asia during the great invasion of steppe forms in Pliocene times. This is more than probable, and I only differ from him in thinking that such invasions and their accompanying climatic changes have been more frequent than he supposed. Recently acquired knowledge of the history of the Grant's gazelle group seems to support this (Bate 1940).

'At the present day both the Nile Lechwe, found only in a few localities in the southern Sudan, and its relative in the Zambezi and Belgian Congo areas have a very restricted range, a natural corollary of their specialized habits, for "broadly speaking, Mrs. Gray's Cob is purely a swamp-loving species, and lives and feeds in water up to its underparts" (Millais, 1924, p. 239).

Antilope sp.

'There are a number of horn cores fully as large and rugose as those of *Onotragus*, but these differ in being placed in a more upright position on the skull, and they also show a different curve of growth. It has not yet been possible to identify this species.

? *Adenota leucotis* (Lichtenstein and Peters). ? White-eared Cob.

'A few horn cores, including part of a slender distal tip, resemble very closely those of the White-eared Cob. At the present day this species is not found closer to Khartoum than 300 miles to the south.

Antilope sp.

'A species represented by horn cores rather similar in size to those of *A. leucotis*, but having straight, deep grooves, and not showing the banded impressions of the horn sheath.

? *Ourebia* sp. ? Oribi.

'This and another small species are the ones referred to above as being represented almost exclusively by worked distal ends of metapodials. The rarity of their remains suggests that they may have been obtained from a distance.

Syncerus cf. *aequinoctialis* (Blyth). ? North-eastern Buffalo.

'A buffalo is represented by over fifty isolated cheek teeth, and part of a mandibular ramus with the last premolar and the three molars. These show the rather more complicated enamel pattern seen in *Syncerus* as compared with *Bos*, and they resemble teeth of Recent buffaloes with which they have been compared.

'Some of the cheek teeth in the collection are considerably larger than those of a Recent example from the Blue Nile. In his interesting review of the African Buffaloes Dr. Christy (1929) suggests that this north-eastern species (*S. aequinoctialis*) belongs to the Dwarf Forest Buffalo (*S. nanus*) group of which it is the largest form, though smaller than the South African *Syncerus caffer*.

'Besides the teeth there is a worn tip of a horn core of buffalo 17 cm. in length by 12·5 cm. at its widest, proximal, end, where it has a thickness of about 6 mm. This specimen is not solid, but has a cancellar structure to the extreme tip. There are also a number of terminal phalanges very similar in size and shape to those of a Recent *S. aequinoctialis*.

'Gaillard (1934, pl. v, fig. 2) has described a fossil buffalo from Kom Ombo, *Bubalus vignardi*, with a horn core quite different in shape from the specimen from Khartoum; in that of *B. vignardi* the base of the horn core is not widely expanded and it appears to have continued for at any rate much of its length with the same proportions; it is elliptical in section. This horn core is unlike that of a typical buffalo, and it may perhaps prove to be that of a large antelope.

'*Equus*' sp.

'The collection includes a single upper cheek tooth of an equine, which is insufficient to show whether it represents a wild ass or a zebra.

Diceros cf. *bicornis* (Linnaeus). ? Black Rhinoceros.

'A Rhinoceros is represented in the collection by a few toe bones, and by an astragalus which is a distinctive bone; this specimen is similar in size to that of a Recent Black Rhinoceros. At the present day this species is found living only in the extreme south of the Sudan; but there is an interesting record by Messedaglia of the occurrence of this animal in northern Darfur less than a hundred years ago which is contained in a manuscript map preserved in the Darfur Province archives. *D. bicornis* cannot be considered as a climatic indicator, for it tolerates environmental conditions of very different types, and may be found in dry scrub-land so long as some water is within reach.

'In connexion with the early Khartoum site it is interesting to learn that recently a member of a Danish expedition shot a small Black .Rhinoceros north of the Lol river in the Bahr el Ghazal Province where it was living in the middle of swamps (Benzon, 1947).

Loxodonta cf. *africanus* (Linnaeus). ? African Elephant.

'An elephant is represented by a single fragmentary specimen which consists of the hindmost two and a half plates of a molar. The crown surfaces had not yet come into wear, so that the moderate height, about 100 mm., of the anterior tooth plate is of little significance. There appears to be a trace of the mesial expansion of the plates so typical of *L. africanus*.

'The Sennar area is the nearest to Khartoum where elephants may be found at the present day, though it is probably not entirely a climatic barrier which prevents a northward advance.

'SOME RECORDS OF FOSSIL MAMMALS FROM THE SUDAN AND UPPER EGYPT

'While studying the present collection of animal remains from the early Khartoum site it was natural to look for records of other fossil faunas from the Sudan and from Upper Egypt for purposes of comparison.

'Such records for the Sudan are singularly rare, and refer to finds of more or less isolated specimens from undated deposits. The later Pleistocene geology of the country is obscure, and it seems likely that deposits have not always remained in their original position.

'Dr. C. W. Andrews described and figured (1912) part of an elephant tooth from the bed of the Blue Nile at Khartoum. It was associated with remains of Hippopotamus, a small Giraffe, and an Antelope. The deposit could not be dated, but may be of early Middle Pleistocene age. Another specimen which might have come from a contemporary deposit, close to the White Nile, was obtained by Mr. A. J. Arkell from a well, at a depth of 45 ft., in his garden at Kosti. This was a last lower molar of an extinct pig, *Hylochoerus grabhami*, described by Dr. Hopwood (1929). Professor Arambourg (1943, p. 475) has recently suggested that this species should be included in the genus *Omochoerus* known from the early Pleistocene deposits of Omo.

'A few animal remains including Hippopotamus and Buffalo were apparently associated with the skull of a proto-Bushman from Singa (Woodward, 1938), but these have not yet been described. In his review of the quaternary geology and prehistory of Egypt Joleaud (1933) refers to a possibly Villafranchian deposit at Khartoum (p. 602) and to one of perhaps St. Prestien times in Nile alluvium at Wadi Halfa, but the documentation of these deposits and their remains is still somewhat obscure (see Lydekker, 1887 and Sandford and Arkell, 1933).

'Interesting animal remains were found at Qau, thirty miles south of Asyut, but unfortunately no definite dating of the deposit is available. A provisional list of species has been published by Professor D. M. S. Watson (1929, p. 541), and these include extinct forms of Giant Cape Buffalo, Hartebeest, and Crocodile. (See Brunton, 1927, p. 12, and Petrie, 1930, p. 1—also Joleaud, 1933, p. 602.)

'A quaternary deposit at Wanyanga on the south-eastern edge of Tibesti to the west of the north-west boundary of the Sudan may eventually prove to be of importance. This is a lake deposit containing remains of Hippopotamus, Elephant, Giant Pig, and Nile Perch (Joleaud and Lombard, 1933).

'The animal remains from the neolithic deposit of Toukh, Upper Egypt, have been studied by Gaillard (1934), who considered that most of the species represented were domesticated; these include Dog, Pig, Short-horned Ox (common), Buffalo, two species of Goat, and a Sheep.

'Perhaps the most important of all is the fauna from Kom Ombo on the right bank of the Nile, north of Aswan, since it was obtained from Vignard's typical Sebilian sites. The remains were studied by

Dr. Gaillard of Lyons, who published a detailed account (1934), and it will be advisable to quote his list of species:

Hyaena crocuta, race *spelaea* . . .	Rare.
Equus asinus (provisional) . . .	,,
Equus caballus ,, . . .	,,
Hippopotamus amphibius race *major* . .	Plentiful.
Bos brachyceros Owen	An imperfect skull.
Bos primigenius	Frontal with horn cores, &c.
Bubalus vignardi Gaillard . . .	,, ,, ,,
Bubalis boselaphus	Not uncommon.
Gazella isabella	Rare.

Dr. Gaillard (op. cit., p. 114) stated that he believed that both *B. brachyceros* and *B. primigenius* belonged to wild and indigenous races, and he makes no suggestion that these might have been domesticated. Good figures are given and show unmistakably the characters of the species they are said to represent.

'At first sight this record appeared to be almost incomprehensible, for it is exactly contrary to the generally accepted theory regarding the origin of true cattle (other than buffaloes) in Africa. The subject has been extensively studied, particularly in south Africa, and there is now a considerable volume of literature dealing with the question. A most generally accepted theory seems to be that there were four migrations of cattle into Africa; the first three began in Egypt, while the fourth came direct from India to east Africa. Of the four types of cattle the earliest was the Hamitic Longhorn, without a hump, domesticated in Egypt about 4000–3000 B.C., followed by the Brachyceros with short horns and no hump about 2000 B.C. These were followed about 1000 B.C. and A.D. 500 by differing types of Zebu, or humped cattle. The Kom Ombo deposits are of course vastly earlier than the above dates. On pondering this question it was evident that the north African coastal region must be considered, for there are many records from Morocco and Algeria, and the question has been summed up by Professor Arambourg (1938, p. 37), who says that the Urus is known since the Upper Pliocene of Constantine and that it is frequent in all levels of the Quaternary up to the Neolithic.

'Dr. Hopwood reminded me of Pomel's work (1894), and I find that this author describes a large and a small bovine from Algeria, the figures of remains of which are almost identical with those of the specimens from Kom Ombo, though Pomel's small form, *B. ibericus*, is said only to occur in neolithic and later deposits.

'From the occurrence of these bovines at Kom Ombo we seem to be forced to conclude that there were migrations of some Eurasiatic types taking place earlier than was suspected and reaching farther south than was formerly realized. After all, it is not really surprising since various African types, such as *Rhinoceros simus*, are known from the north African littoral. It is evident that there is yet much to be learnt about early days in the area west of Egypt and the Sudan. The remains of related species of *Thryonomys* in the Sahara and at Khartoum are also probably a link in this history.

'In view of the fact that archaeological connexions have been found to exist between the early Khartoum site and sites lying between the massifs of Ahaggar and Aïr in the western Sahara, it may not be out of place to mention that such a connexion is to a large extent supported faunistically at the present day. The fauna of Ahaggar to the north of Aïr is said to be largely palaearctic in character (Meinertzhagen, 1934, p. 551), but both Hyrax and Hippopotamus, nowadays practically confined to Ethiopia, still occur. Of greater interest is Aïr, which is also a very isolated area, and the fauna is a relic one which is largely tropical in nature. The following quotations provide a few striking facts

which undoubtedly point to a former closer climatic connexion between the Anglo-Egyptian Sudan and the western Sahara: ". . . the mammals are on the whole Sudanese forms or close allies of such"; "The birds show once more that the Sudan from east to west, like the Saharan province, forms a uniform faunal zone" (Hartert, 1921, pp. 79, 80). Thomas and Hinton (1921, p. 2) in writing of the Recent mammals of Aïr say: "The additional species are all local representatives of forms known either in North Nigeria, in Algeria, or in the Anglo-Egyptian Sudan, the nearest relationship being evidently with the last-named."

'SUMMARY

'The large collection of vertebrate animal remains consists almost exclusively of bones, usually broken, of animals that have been used for food. This naturally provides a clue to some of the customs of the inhabitants of the Khartoum early site. It has already been described how the height and position of the river in relation to the site was completely different at the time of the occupation from what it is to-day. The immense quantities of fish remains, as well as those of River Turtle and Hippopotamus, are sufficient evidence of the importance which the river itself played in the economy of the people. That the river was at least bordered to a considerable extent by swamps might be expected, and this is confirmed by the presence of the Nile Lechwe, an antelope which is exclusively a swamp-dweller. The Reed Rat and Water Mongoose are other swamp-loving animals, while Buffalo must be within reach of water, and may even haunt swamps and reed beds. Most of the other species represented are fairly tolerant of different conditions, although warmth and a permanent supply of water are essential. The presence of other antelopes and an Equine suggests the vicinity of drier ground at no great distance.

'From the faunal remains it is evident that the inhabitants lived by fishing and hunting, and they occasionally showed considerable ingenuity in making weapons for catching their prey. It seems as if some small antelopes may have been specially sought after for the purpose of making use of some of the bones. There are no remains in the collection which might even suggest that the people had achieved the domestication of animals; a similar conclusion was reached by Dr. Derry.

'So far as can be judged without a knowledge of the actual species represented, the mammal fauna, with one exception, is not unlike what may be found to-day in southern parts of the Sudan. This one exception, however, is so significant that it necessitates caution in forming conclusions about the remainder of the fauna which cannot be so closely identified.

'This important exception is the extinct Reed Rat, *Thryonomys arkelli*, which has been described and figured above. A few points of interest may be mentioned:

(*a*) it is a species very distinct from others known;
(*b*) it is an extinct species;
(*c*) it is less specialized than modern types;
(*d*) it does not belong to the group of which representatives are now found living in parts of the Sudan;
(*e*) it is related to forms found in deposits in the northern and western Sahara.

Some of the implications suggested by the above points are of far-reaching interest. The presence of this extinct and very distinct species, *T. arkelli*, suggests that other extinct forms may also be present were the remains sufficiently perfect for close study. This, and the fact that *T. arkelli* is a primitive form, indicates a considerable age for the deposit, and the possibility of a change of fauna having taken place between the time of the early Khartoum site and the present day. Such a change is almost invariably accompanied by some climatic change.

'That there was some such climatic fluctuation receives support from the group relationship between

these swamp-dwelling Reed Rats *T. arkelli* and the fossil forms found in the Sahara; and such a change of climatic conditions would necessarily have had to be one independent of varying levels of the Nile. Many relic faunas in the Sahara are witnesses of climatic conditions very different from those of the present day, and the discovery of *T. arkelli* suggests their great geographical extent, covering much of Saharan north Africa and spreading as far as Khartoum. Alternations of wetter and drier periods no doubt took place in these regions a number of times. The bovine remains from Kom Ombo also seem to witness to these climatic fluctuations, but further careful excavation and records are an urgent need towards the understanding of the history of the Sudan and its relationships with north Africa from Upper Palaeolithic to our own times.'

MOLLUSCA

Specimens of all mollusca collected, with the exception of *Ampullaria wernei* Phil., *Lanistes carinatus* Oliv., and *Aetheria elliptica* Lam., were sent to the late Major M. Connolly at the British Museum (Natural History) for identification.

The following snails appear to have lived on the site:

Zootecus insularis Ehrn. occurred plentifully in the fine buff sand under the layers containing occupation debris, and literally thousands of shells were recovered by the sieve from occupation layers believed to be undisturbed in squares M 17–30. Colonel A. J. Peile has collected the shells of this species in Gold Mohur Valley, Aden, under stones among the roots of stunted bushes, where rain only falls at rare intervals and temperatures are high, though the drought may be mitigated by moisture from the sea air. But I have been unable to ascertain what is the minimum humidity it requires, for no one seems to have found it alive. It probably takes refuge from drought by going underground, and coming up at night when conditions are favourable.

Limicolaria flammata Caill. with var. *gracilis* Mts. and var. *candidissima* Shutt. occurred throughout the occupation layers, and was living on the mound during and perhaps for some time subsequent to the early occupation. More than 300 complete shells, both mature and immature, were recovered and very many broken fragments noticed. A proportion of the shells had the mouth still sealed with a thick film of dry mucus, which this snail uses to protect itself against drought when aestivating. Eighteen specimens showing the extreme range of variation in size were sent to Major Connolly, who reported that one of the fattest coincided with the figure of *candidissima* in Shuttleworth, 1856, p. 49, pl. VI, figs. 7 and 8. Var. *gracilis* does not exceed 50 mm. long when full grown. For further discussion on the life-habits of this species and the implications of those life-habits see pp. 109–10.

Ampullaria wernei Phil. Mature and immature shells, both with the operculum in position and coated with kankar (over 350 complete shells in all), were found among the occupation debris, together with a large number of partly broken shells. This indicates that this species was living on the mound in the rainy season during the early settlement. Very many broken fragments, thickest where occupation debris (sherds, stone artifacts, &c.) were thickest, and sometimes packed in pockets of almost pure shell fragments, were found in the occupation layers, suggesting that this snail was eaten. Over 14 gallons of shell fragments, mostly *Ampullaria*, were found by the sieve in about 12 cubic metres excavated in square M 17, and it was not particularly thick with shell fragments. About 120 gallons of shell fragments, mostly *Ampullaria*, were discarded from the squares sieved (M 17–30). It is possible therefore that at certain times of the year this snail may have formed an important item in the diet of the early people. *Ampullaria* is, however, never eaten by the modern Nilotes, although it is extensively used by them as bait for fishing both in the orthodox fashion and also sometimes as a kind of primitive spoon-bait in the fashion described by Evans-Pritchard, 1940, p. 72 and fig. 10,

with the result that their fishing camps are strewn with fragments of *Ampullaria* shell; and it may be that the chief use of this snail by the people of the early settlement was for bait, for possible fishing-line sinkers were found (see p. 68), and they may have used natural bone splinters for gorges, although no fish-hooks were found. For the suggestion that they may, like the present-day Nilotes on the upper Nile, have used the shells of this snail as cups and spoons, see p. 31. The largest shell recovered measured 85 mm. in height and 80 mm. in breadth.

Lanistes carinatus Oliv. has similar habits to *Ampullaria* with which it is often found living. About thirty whole shells were recovered, of which the largest was 52 mm. in diameter. Not many broken fragments were found; and it is concluded that this snail lived on the mound in the wet season and was not imported by the early people.

The above four species, the first two terrestrial and the other two semi-aquatic, were much the most important molluscan inhabitants of the mound in point of numbers.

Four specimens of a possibly new species of land snail, *Trochonanina* sp., were recovered by the sieve from occupation layers in squares M 17–30. Two specimens are now in the British Museum (Natural History) and two in the Khartoum Museum. Major Connolly, who identified them, reported that 'their small size suggests that they may possibly represent a yet undescribed species, but more material would be necessary to establish such a fact'.

Pupoides sennaariensis Pfr. Five specimens, one from square M 26, at about R.L. 378 m., below the base of the occupation layer.

Bulinus truncatus Audouin. One specimen from the base of the occupation layer in square M 17.

Bithynia sennaariensis Kust. Twenty-two specimens. Possibly living on the mound under similar conditions to *Ampullaria* and *Lanistes*.

Shells of the following freshwater molluscs were also found among the occupation debris:

Cleopatra bulimoides Oliv. Not common (37 specimens). Occurred mostly below the occupation layer at R.L. 377·5 m. in square M 31 together with some shells of *Ampullaria wernei*.

Viviparus unicolor Oliv. Two specimens.

Aetheria elliptica Lam. The Nile Oyster. See pp. 12–13. Parts of several immature shells were adhering to part of a ferricrete sandstone grinder found among other occupation debris in square K 26, and a fragment of ferricrete conglomerate with part of a larger specimen adhering was found in square M 25. Specimens covered with kankar were also found in layers 130–40 cm. and 160–80 cm. in square M 26. As these squares are all in the vicinity of what was found to have been the bank of the Blue Nile at high river, the indication would seem to be that the Blue Nile remained in flood long enough for *Aetheria elliptica* to attach itself to stones, &c., near the high river bank, which means a much longer duration for the peak of the flood than now.

Aspatharia rubens Lam. and var. *caillaudi* Mts. About twenty whole valves and a number of fragments. Valves of this shell may have been used by the early inhabitants, as still in the Sudan to-day, as spoons or ladles, but judging from numbers it was not important to the early people. One valve with a worn edge, that may have been a potter's tool, is discussed on p. 92.

? *Aspatharia wahlbergi hartmanni* Mts. One valve.

? *Chambardi locardi* Bgr. One valve.

Mutela angustata Sow. Seven valves and some fragments.

Corbicula africana Krs. A few valves.

The following table shows molluscs found in sieving the spoil from conventional layers in squares M 26–30.

TABLE OF MOLLUSCA FROM SIEVED LAYERS

Square and layer (cm.)	*Limicolaria flammata*		*Zootecus insularis*	*Ampullaria wernei*		*Lanistes carinatus*		*Other species*
	Mature	*Immature*		*Mature*	*Immature*	*Mature*	*Immature*	
M 26								
20–30	+	+	+	+	..	..	..	? *Aspatharia rubens* frag.
30–40	+	+	..	+	..	+	..	..
40–50	+	+	+	..	..	..	..	*Bithynia sennaariensis.*
60–70	+	+	..	+	..	..	..	..
70–80	+	+	+	+	+	..	+	*Pupoides sennaariensis* and ? *Aspatharia rubens* frag.
80–90	+	..	..	+	..	+	..	..
90–100	+	..	..	+	..	..	..	..
100–10	+	..	..	+	..	..	..	*Mutela angustata* frag.
110–20	+	..	..	+	..	..	..	*Aspatharia rubens* frag.
120–30	+	..	..	+	..	+	..	*Aspatharia rubens.*
130–40	+	+	..	+	..	..	..	*Aetheria elliptica* imm.
140–50	+	+	..	+	..	..	..	..
150–60	+	+	..	+	..	..	..	..
160–80	+	..	..	+	+	..	..	*Aetheria elliptica* imm.
190–200	+	..	..	+	..	..	..	..
200–70	+	..	..	+	..	..	..	..
M 27								
25–60	..	+	..	+	..	..	+	? *Mutela angustata* frag.
60–80	..	+	..	..	+	..	..	..
80–100	..	+	..	+	..	..	+	..
100–20	+	..	..	+	..	..	..	*Aspatharia rubens* frag.
140–60	+	..	..	+	..	..	..	..
160–80	+	+	..	..	+	..	..	..
200–57	..	..	..	+	..	..	..	..
M 28								
100–20	+	..	..	..	..	..	..	..
120–40	+	..	..	+	..	+	..	..
140–60	..	..	..	+	..	..	..	..
160–80	..	..	..	+	..	..	..	..
180–200	..	+	..	+	..	..	..	*Aspatharia rubens* frag.
200–20	+	+	..	+	..	..	..	..
R.L. 378·90	..	..	..	..	..	..	..	*Pupoides sennaariensis.*
M 29								
120–40	+	..	+	+	..	..	..	..
180–200	..	..	..	+	..	..	..	..
200–20	..	..	..	+	..	..	..	..
M 30								
180–200	..	+	..	..	+	..	..	..

CHAPTER IV

THE HUMAN REMAINS

SOME bones from seventeen burials associated with the early settlement, and of each of which at least some few bone fragments remained where they had been buried in the settlement site, were found during the excavation. That they belonged to the early settlement was clear both from their association with calcified and in some cases calcreted occupation debris which had escaped subsequent disturbance, and from the fact that the bones themselves were all more or less heavily coated with kankar (see p. 9). The bones from Meroitic burials in the same site were, however, as has already been mentioned, white and, as far as the eye could see, uncalcified.

Numerous other fragments of fossilized human bone were found in disturbed layers all over the site. A remarkable fact, which at first led to a suspicion that the early inhabitants might have been guilty of cannibalism, was that the layers of grey kankar in almost every case covered the broken surfaces of the bones, although fragments of fossilized human bones with white edges, where broken by recent grave-digging, did occur; but, after consideration of the evidence, there can be little doubt that the bones were in many cases crushed and broken during the original occupation of the site before the water-table had fallen and the deposition of kankar had ceased. Pl. 8, Figs. 1 and 2, show some of the remains of bodies that had been buried with care, but in which the bones had been broken into many fragments, the fragments being all completely fossilized. A good example may be seen in Fig. 6, which shows all that was left of the burial of a young mother with her child, in a tiny 'island' between three recent graves.

A schedule at the end of this chapter shows such details as it was possible to recover about these early burials. The two most complete burials were found in squares M 20 and 21 by Mr. Debono during my absence. These were only 3 to 4 cm. below the present surface of the mound, indicating that considerable erosion of this part of the site must have taken place since burial.

In all burials where enough remained to show the position in which the corpse had been buried, it was seen that it had been tightly contracted. Judging from such evidence as survived, it seems unlikely that much, if any, attention was paid by the early inhabitants to orientation when burying the dead.

No evidence was found of the burial of grave goods with the dead, apart from their personal ornaments, but this is only negative evidence and in the disturbed state of the site by no means conclusive. The corpse in M 20 (2) had been buried wearing an ostrich egg-shell disk-bead necklace, and in M 21 a piece of a large Wavy Line pot had been used as a pillow for the skull. In burial N 24 (3) a complete large *Ampullaria* shell seemed possibly to have been associated with the burial. (For snail shells still used in the Sudan as drinking-vessels and spoons see Jackson, 1933, p. 127 and p. 124.)

All skull fragments, together with all surviving bones from burial M 20 (2), and a gnawed bone from burial N 20 (2), were sent to Dr. D. E. Derry at Cairo, and his report on them is printed here.

REPORT ON THE HUMAN REMAINS

By Dr. D. E. Derry

The remains from the early site in Khartoum which have been submitted for examination are with one or two exceptions only fragments. These are of a greyish colour, very hard but brittle, and ring like pottery, when struck, being impregnated with calcium carbonate. This mineralization appears

to have taken place since the disturbance and breaking-up of the bones, as the fractured edges, except where quite recent, are in the same state as the surface.

In only one instance has it been found possible to restore the skull sufficiently to allow of at least an ocular judgement of the physical features. This skull with parts of the skeleton is numbered M 20 (2), and after removal of the paraffin wax by heating, an attempt was made to restore the numerous parts to their proper positions. There were over thirty separate pieces, but although some of the fragments fitted perfectly, or at least appeared to do so, when the larger pieces thus formed were brought together they failed to coincide. This is a common experience where bones have lain for long periods in the ground. The combined effects of moisture and grave-pressure tend to produce a warping of the bone, with consequent distortion, which is very obvious when the skull is repaired. In the present instance it is the more disappointing as there is no other skull of this group which can yield so much information as to the physical features of these people.

In spite, however, of what has been said, the general characters of the skull, and in particular those of the face, can be clearly recognized. The skull appears to have been long and narrow, but the latter dimension is possibly slightly exaggerated by lack of fit of the bones. In the skull as restored the bi-mastoid diameter is greater than the bi-parietal, a primitive feature. The mastoid region and base of skull are rugged. The face is long but the length is masked by its great width, the bi-malar diameter being in the neighbourhood of 108·0 mm. as measured on the restored skull. The depth and prominence of the malar region are very marked. The nose is flat at the bridge and wide. The nasal bones are narrow. The anterior nares are wide and the lower edge is rounded. Below the nasal opening there is a marked flattening of the incisive fossa due perhaps in part to absorption of the alveolus after removal of the central incisor teeth. This exaggerates the canine eminence and adds to the simian expression of this part of the face. The removal of the incisor teeth is a common practice amongst many African tribes to-day and was met with in the human remains brought to light at Jebel Moya in 1911–12. There it was the rule to find that the lower incisor teeth in the women had been removed and this was associated with wearing an ornament in the lower lip. In the Jebel Moya men removal of the teeth was less common, but in a few cases both upper and lower incisors were removed. In the present case the teeth are in excellent condition and only moderately worn. Their arrangement exhibits the parallelism so often seen in negro crania which is associated with prognathism and contrasts markedly with the horse-shoe shape of the dental arch in most other races. The mandible is massive and the ramus wide and low, a well-recognized feature in the negro. As the ramus is broken away on the left side and incomplete on the right, the mandibular angle cannot be accurately measured, but it seems likely that it did not exceed 110°. This again is a negro character. Fortunately, however, we are not confined to this one example, as amongst the numerous fragments carefully collected by the excavators we have the mandible of M 21 (2A) which, although in four pieces, was repaired and gives on the mylometer an angle of 114°. The parts of two other mandibles M 18 (5) and Q 22 (2) have been examined and they confirm the statement made in regard to M 20 (2). While the features exhibited by the ramus of the mandible are, as already said, common in negroes and distinctly simian, the depth of the symphysis and the relative prominence of the chin are the reverse. This was noted at Jebel Moya and also eversion of the angle of the ramus which gives the face a quadrangular appearance. This can be seen in the photograph (Pl. 7, Fig. 1) where the skull M 20 (2) is shown beside a negro skull from Dr. Reisner's excavations at Kerma. The massiveness of the face and jaws in the Khartoum skull is also well shown and contrasts markedly with that in the man from Kerma.

Owing to the destruction of the skeleton, measurements of the long bones were not possible. However, the right tibia, in three pieces, gave an approximate measurement of 446·0 mm. which by Pearson's formula for the construction of living height from dead long bones makes this man to have

been about 6 ft. The body was buried in the flexed position, and in one of the fragments, held together by paraffin wax, the right foot is resting against the right hip-bone. This implies very acute flexion at the knee-joint. The right hand was resting against the upper part of the right thigh.

From what has been said above it will be realized that we are dealing with a definitely negroid race and a detailed examination of the many fragments recovered confirms this statement. In this connexion it is relevant to refer to the results obtained from the few intact crania recovered from Sir Henry Wellcome's excavations at Jebel Moya, a place situated rather less than 200 miles south of Khartoum and just over 20 miles west of the town of Sennar. The average length and breadth of 17 male skulls from this place showed them to be relatively short and wide, being 180·9 mm. in the glabello-occipital diameter and 138·3 mm. in their maximum breadth, giving a mean Cephalic Index of 76·9. It was this character of mesaticephaly which first showed that we were dealing with a race other than the Nilotic negro whose skull is peculiar in its length and narrowness. The skull M 20 (2) from the Khartoum site, so far as can be gathered from its reconstructed appearance and measurement, is, as said above, long and narrow, but no stress can be laid upon a single example as representative of the people of this site. At the same time the description given for the Jebel Moya skulls may be quoted, as it fits the skull M 20 (2) perfectly. 'An inspection of the skulls shows them to be very rugged and heavily built. This character of ruggedness is particularly well marked in the base where the enormous mastoid processes and very prominent occipital condyles are a striking feature.' The report continues: 'Turning now to the facial portion of the skull one is struck by the massiveness of this as a whole, and particularly by the size of the jaws. The face is unusually long though this is partially masked by the width and also by the depth and prominence of the malar bones, which form one of the characteristic features of these skulls.' This exactly describes the Khartoum skull (see Pl. 7) and almost certainly applies to the average from the Khartoum site. There is no doubt whatever that we are dealing with a negroid race of heavily built people. So far as evidence from the teeth is available it is certain that the habit of removing the *lower* incisor teeth in the women, which was the rule at Jebel Moya, did not obtain amongst the early Khartoum people, so this would seem to preclude a racial connexion between these two groups. On the other hand, we have three cases of removal of the *upper* central incisors, one in the skull described above and two in what may be women. Further, the Khartoum people were obviously riverain and lived in all probability by hunting and fishing, whereas the Jebel Moya people were hill-dwellers like the Nuba of to-day.

No.	*Square and diary no.*	*Plate reference*	*Depth of burial below present surface*	*Description of remains*	*Position of burial*	*Sex*	*Objects in grave*
1	K 21 (6)		63 cm.	Fragments of mandible, ribs, and L. humerus and radius.	? Head to S. Slightly on L. side with humerus parallel to body, forearm flexed to some extent.	..	..
2	L 26 (11)		100 cm.	Some fingerbones, fragment of radius, pelvis, and top of R. femur.	? Head to N., head of femur was in position with regard to pelvis.	..	..
3	M 18 (5)		40 cm.	Part of skull in fragmentary condition, radius, ulna, fingerbones, and fragment of humerus, all R.	Head to N., lying on back.	..	..
4	M 20 (1)		Just below surface	Fragments of skull and mandible, R. and L. humerus, and some ribs.	Head to N., facing W.	..	..
5	M 20 (2)	Pls. 7 and 8, Fig. 1	Just below surface	Skeleton almost complete, with one femur disturbed (found about 110 cm. to N.).	Head to W., facing ? N.: very tightly contracted, with foot near pelvis, the upper part of the body on its back.	M. ?	Ostrich egg-shell bead necklace of 34+ beads.
6	M 21 (2)	Pl. 8, Fig. 2	4 cm.	Skull in crushed condition, upper vertebrae, some ribs, and fragments of R. and L. radius and ulna: fragment of knee-bone close to mandible (fragment of pelvis and of femur possibly removed by excavators before it was recognized as a burial).	Head to W., facing N.: apparently tightly contracted.	..	Skull resting on a large sherd of Wavy Line pottery.
7	M 21 (2A)	,,	..	Crushed skull with mandible in 4 pieces; upper vertebrae, some ribs, fragments of R. and L. humerus. This skull was immediately underneath the skull of No. 6, and it may have been a double burial. ? Immature.	Head to W., ? lying on back.	..	..
8	M 21 (6)		4 cm.	Fragments of skull, some vertebrae and ribs in position.	Head to SW.	..	One ostrich egg-shell bead.
9	N 20 (1)		Near surface	Fragments of R. femur, of R. and L. humerus, radius, and ulna, and of pelvis.	? On back: head to NW.	..	..
10	N 20 (2)		25 cm.	Fragments of R. and L. femur, possibly in position (one gnawed by ? hyena).	?	..	..
11	N 21 (3)	Pl. 8, Fig. 6	55 cm.	Crushed skull and ribs of one skeleton, and facial portion of skull of another immature skeleton.	11. Head to N., facing E.: on L. side, both arms bent.	F.	..
11A					11A. Head to N., facing W. (a double burial with faces touching).	?	..
12	N 24 (3)		46 cm.	One femur nearly complete, fragments of other femur and of ulna.	?	..	Large *Ampullaria* shell possibly associated.
12A	N 24 (4)	Pl. 8, Fig. 3	63 cm.	Mandible and fragments of maxilla, fragments of ribs, of clavicle, and of humerus. (Possibly the same burial as No. 12.)	?	..	..
13	O 21 (1)		10 cm.	Fragments of R. and L. humerus.	? Head to E.	..	..
14	O 21 (5)	Pl. 8, Fig. 4	17 cm.	Crushed skull with frontal portion and maxilla missing, mandible, L. radius, and fragment of R. radius.	? Head to SE., facing NE.: L. hand under skull.	..	..
15	Q 22 (2)	Pl. 8, Fig. 5	3 cm.	Skull, mandible, fragments of R. and L. humerus.	Head to S., facing W.: L. hand near face, R. hand under skull.	..	..
16	Q 22 (3)		30 cm.	Fragments of skull.	Head to N., facing W.	..	..
17	R 25 (2)		40 cm.	Fragments of occiput and radius.	..	..	..

Fragments of human skulls in the fossilized condition typical of the early burials were found in the following squares:
I 14; J 14; K 15, 16, 17, 18, 19, 21, 22, 23, 24; L 14, 15, 16, 17, 18, 22, 24, 25, 26; M 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 31; N 19, 20, 21, 22, 23, 24, 25; O 20, 21, 22; P 19, 20, 21; Q 19, 20, 21, 22; R 21, 22, 23, 24; S 22.

Other human bones in similar condition were found in the following squares:
J 14; K 15, 16, 17, 18, 19, 21, 22, 23, 24; L 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26; M 19, 21, 22, 23, 25; N 19, 20, 21, 23, 24; O 20, 21, 22; P 19, 20, 21; Q 19, 20, 22; R 22, 23, 24, 25, 26; S 22.

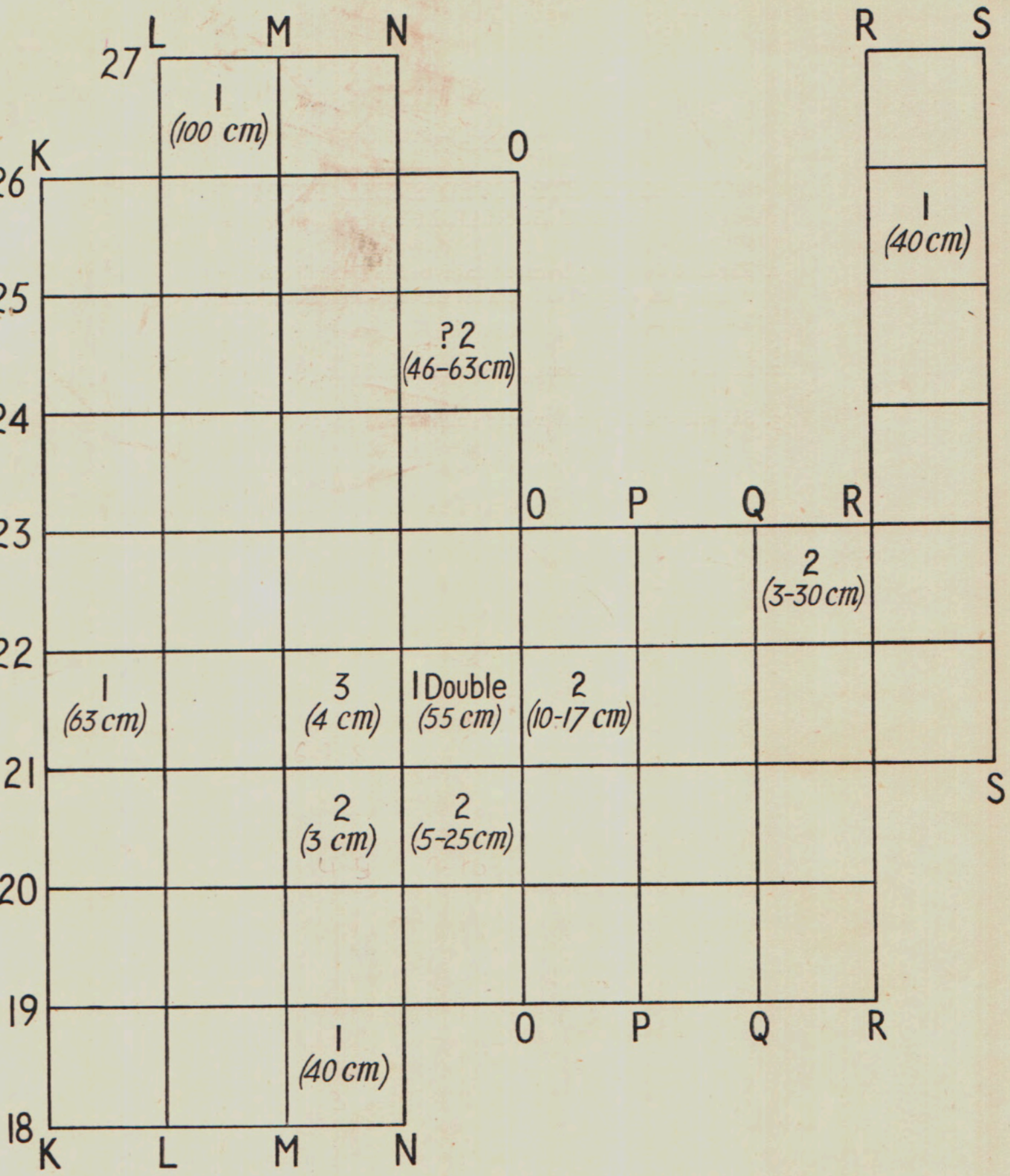


Fig. 4. DISTRIBUTION OF EARLY SETTLEMENT BURIALS OF WHICH SOME PORTION REMAINED UNDISTURBED

The depth of the burial below the modern surface of the ground is given in brackets

PLATE 7

THE RECONSTRUCTED SKULL FROM EARLY BURIAL M 20 (2)

1. The skull from early burial M 20 (2) beside the skull of a negro dating from *c.* 1700 B.C. from the Harvard–Boston excavations at Kerma.

2. Front view of the reconstructed skull from M 20 (2).

3. Side view of the reconstructed skull from M 20 (2).

1

2

3

THE RECONSTRUCTED SKULL FROM EARLY BURIAL M 20 (2)

PLATE 8

EARLY BURIALS

1. M 20 (2).

2. M 21 (2) with M 21 (2A) just appearing.

3. N 24 (4).

4. O 21 (5).

5. Q 22 (2).

6. Double burial N 21 (3).


1

2

3

4

5

6

EARLY BURIALS

CHAPTER V

PERSONAL DECORATION

Artificial deformation of the body

IT has been seen that the upper central incisor teeth were removed, apparently by both men and women (see p. 33).

PIGMENTS

Red pigment

Many lumps of 'red ochre' were found during the excavation. They varied in size and in shade from bright red to dull dark red, and in texture from sandstone through mudstone to clay. Their origin was no doubt the Nubian Sandstone in the vicinity of Omdurman, whence they must have been brought both for personal decoration, smearing the body according to the common practice of primitive people, and for the purpose of providing a red slip for the pottery.

Yellow pigment

Lumps of yellow mudstone of various sizes and shades from bright orange to dull yellow were also found, though these were not so numerous as the red pigment. Yellow mudstone is found locally, but the Government Geologist compares some of the examples to mudstone found near No. 1 station and in the Umm Nabardi area.

This pigment was presumably used for decorating the person.

White pigment

A few lumps of this were found, several being definitely shaped by having been rubbed on some object (Pl. 9, Fig. 1). It is typical clay from the Nubian series as found in the Omdurman area. Some sherds showed traces of a cream slip, so this pigment may have been used for colouring pottery as well as for decorating the body.

Blue pigment

One small piece of pale blue mudstone of Nubian type was found on the site. No local occurrence of mudstone of this colour is known to the Government Geologist, but there is a similar grey mudstone which is quarried by the Sudan Railways near Station No. 1. A single specimen is obviously not important, and may not be contemporary with the early settlement.

BEADS

Disk beads

Disk beads of ostrich egg-shell, *Ampullaria* shell, and natural limestone were worn by the inhabitants of the early settlement.

Thirty-four disk beads of ostrich egg-shell were recovered from near the neck of the skeleton in burial M 20 (2) (see p. 31 and Pl. 9, Fig. 3). Several other beads from the same necklace were attached by kankar to the bones of the skull. The beads in this necklace varied from 7 to 9 mm. in diameter and had holes from 3 to 4 mm. in diameter bored from one side, no doubt with the small quartz borers, which are figured on Pl. 14, Figs. 4–6, and described on p. 44. Eight disk beads of ostrich egg-shell with diameter 12 mm. and holes 3 to 4 mm. in diameter, cemented together with kankar as strung, were found in square M 16; and four groups of 13, 8, 8, 9 (total 38) disk beads of ostrich egg-shell with diameter 11 mm. and holes about 3 mm. in diameter were found in squares K 16, L 15, M 15, and M 18, and may possibly all have come from the same string. Several other

small groups of disk beads cemented together with kankar were found, the smallest being 5 mm. in diameter with a hole 3 mm. in diameter (Pl. 9, Fig. 5).

The comparatively large size of the holes in the early disk beads should be noted. They are much larger than the holes in the shell disk beads from the Meroitic graves (see Pl. 108, Fig. 2, and pp. 122–3). This is, of course, natural, for the early people had only stone borers, while Meroitic people may have used metal awls. (For a note on the manufacture of disk beads of shell in modern times in the Sudan, see Arkell, 1945A, pp. 307–10.)

A proportion of the disk beads from the early site are black. They were not found in association with any of the burials, but over seventy-five in all were found, most of them covered with a film of kankar; one was recovered by the sieve from the bottom layer (200–57 cm.) in square M 27, and one was found *in situ* at R.L. 380·8 m. in a black pocket of almost solid occupation debris in square L 26. At first it was thought that these beads were made of blackened ostrich egg-shell, but a number of them were sent to the late Mr. A. Lucas, O.B.E., for examination, and he reported as follows: 'The material is calcium carbonate, and in my opinion the beads are made of naturally black limestone, which is not very uncommon. They are too thin for ostrich egg-shell, which is often as much as two millimetres in thickness. Also ostrich egg-shell is fairly smooth even on the inside, which these beads are not.' Ostrich egg-shell does, however, get rough and thin when it begins to decompose, and it also wears thin; many of the beads from the early settlement were well worn. This rendered more difficult the differentiation by eye of beads made of ostrich egg-shell from those made of snail shell. Further, while fragments of *Ampullaria* shell abounded on the site, fragments of unworked ostrich egg-shell were very rare, only two being recorded (from squares M 17 and N 19), there being nothing to indicate that they were contemporary with the early settlement. Three unfinished beads of ostrich egg-shell were found, two had been perforated, probably with a quartz borer, but not rounded, and one had been broken across the perforation. (One small oval disk of ostrich egg-shell, 14 mm. at the greatest diameter, carefully cut and rounded but not perforated, was found in square M 25.)[1] Ostrich egg-shell, therefore, though worked on the site, was apparently not plentiful, and it is probable from the well-worn condition of many of the beads that they were usually obtained ready-made from elsewhere.

Since in the different stages of fossilization, wear, and decomposition of the disk beads it was difficult to be certain about the material from which many of them were made, the help of the Government Geologist was called in, and he very kindly examined under the microscope several of the beads, several known shell fragments (ostrich egg-shell, fossil and recent *Ampullaria* shell), and a disk bead, believed to have been made from the shell of the large land mollusc *Burtoa nilotica* Pfr. that was taken from a recent string of disk beads made by the Nuer and now in the Khartoum Museum (catalogue No. II. 948).

One of the black disk beads pronounced by Lucas to be natural black limestone was crushed, and it was found on petrological examination to be dark-grey limestone with a scattered pigment, probably carbon (natural pigment). Crystals of blue-green amphibole were noted in the debris, and this led the Government Geologist to conclude that the bead had been made from a black nodule of kankar originally formed in the Blue Nile clay. Two other black beads which he examined in the same way were also considered to be kankar, although no amphibole was seen, and in only one of them did any crystals (felspar) other than calcite appear.

One of two disk beads that appeared to have been made of pink stone was examined petrologically; and it was found that when immersed in acid the pink colour disappeared, and that the bead was made of a cream-coloured fine-grained limestone with some brown spots. The insoluble residue from the

[1] Compare examples from Final and Neolithic Capsian sites at Tabelbalat illustrated and described as unfinished beads by Breuil, 1931, fig. 39.

pink stain contained clay, diopside, and blue-green amphibole, the clay material being reddish in reflected light; and it is suggested that probably the clay came from the Nubian deposits in the Omdurman area. (In fact it may have come from 'red ochre' on the skin of the person who wore the beads, or possibly the beads may have been coloured with it on purpose.)

It was found under the microscope that *Ampullaria* shell breaks into rod-like prismatic fragments; and only one of the beads crushed appeared like it. Crushed ostrich egg-shell has a granular structure with no minerals other than $CaCO_3$, and a finely fibrous appearance was noted in many of the crushed fragments. A number of beads crushed had this character. The bead believed to be made from *Burtoa* shell gave many prismatic and some granular fragments (with some chitin), and appeared to be different from all the beads from the excavation that were crushed.

After examining beads in this way with the Government Geologist, the conclusion was reached that many of the thin disk beads that had been thought to have been made of *Ampullaria* shell were really worn beads made of ostrich egg-shell; and the resulting analysis of disk beads that from the size of their holes and/or the amount of fossilization are associated with the early site is as follows:

Ostrich egg-shell	334	
Ampullaria shell	11	
Black natural limestone (probably kankar) .	92	
Other natural limestone	6	(one of sandy limestone ? = kankar, one of a fine-grained marble).
Doubtful	54	

The maximum diameter of beads made either of ostrich egg-shell or of black limestone was 12 mm. and the minimum diameter was 5 mm. In all cases the diameter of the hole varied from 3 to 4 mm. For photographs of some individual beads see Pl. 9, Fig. 4.

Possible sandstone bead

A small rough irregular bored sandstone ring, with a maximum diameter of approximately 36 mm., and an elliptical hole with diameter from 6 to 8 mm. bored from both sides, was found in square I 14 and is shown on Pl. 9, Fig. 2. It may have been a bead.

Clay beads

A number of small clay objects of uncertain use were found and are described in Chapter VIII. Five at least were almost certainly beads, but as the use of clay beads continued in the Sudan to a comparatively late date, it is not certain that they were all contemporary with the early settlement. One or two of the clay objects may have been used as pendants.

Beads made from the vertebrae of a python

In a disturbed layer were found what appeared at first sight to be the fossilized remains of a snake that had died in a coiled position. They were, however, identified by Dr. Swinton of the British Museum (Natural History) as the vertebrae of a Python, which had been rubbed down until the processes had been removed (see Fig. 5 on p. 40). They had been strung and worn as an ornament, possibly round the arm or leg, judging from the curved position in which they were cemented together by kankar and the indication that they had been worn at least twice round the limb they had decorated, for two series of vertebrae lay cemented together by kankar alongside each other.

It is interesting to note that python vertebrae from which the processes have been removed by cutting them away with a spear-head, though not as severely as in our early specimen, are still worn as waistlets by the Dinka and Nuer of the Anglo-Egyptian Sudan, vide two specimens Nos. II. 19 and II. 868 in the ethnological collection at the Khartoum Museum; but these modern waistlets are

apparently always worn as single strings. District Commissioner, Western Nuer, reports that they are worn as charms against magic and in order that the cattle of the wearer may be fertile and produce cow calves.

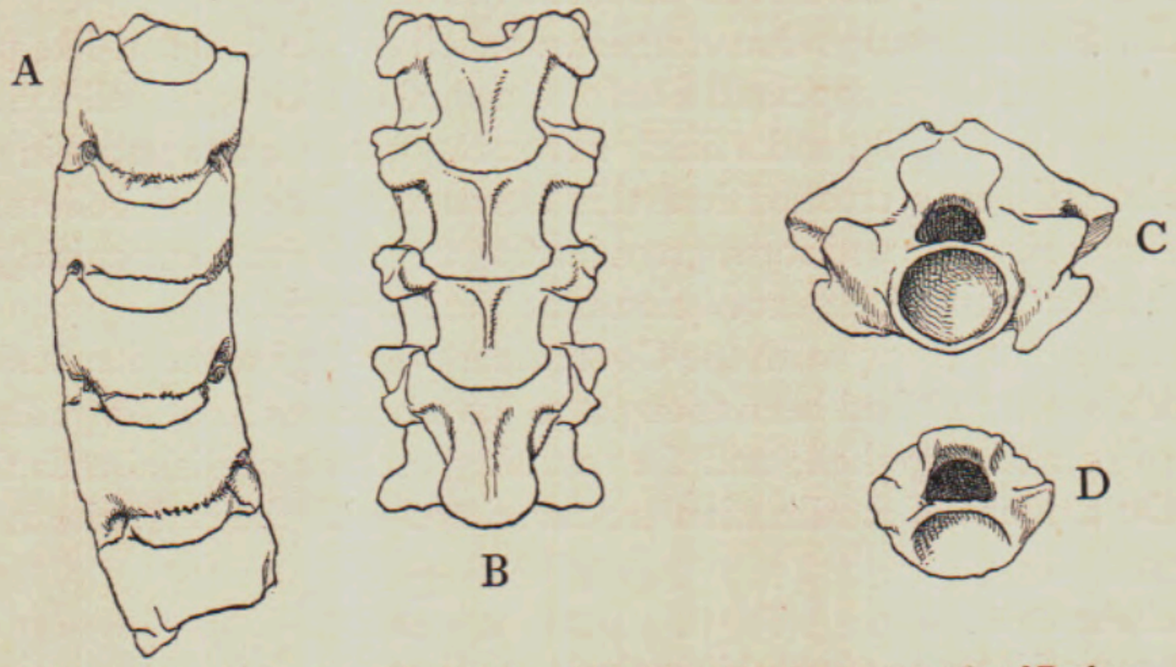


FIG. 5. Vertebrae of Python × 1½. A. Portion of ornament made of Python vertebrae with processes removed. B. Four vertebrae of a recent Python, in natural condition. C. Anterior view of vertebra, natural condition. D. Ditto, processes rubbed down.

PENDANTS, ETC.

No doubt feathers that have perished, and bones and possibly the claws of animals and beaks of birds were used for personal adornment, as they still are to-day in the Sudan in parts of the Nuba Mountains, where beetle-cases are also worn.

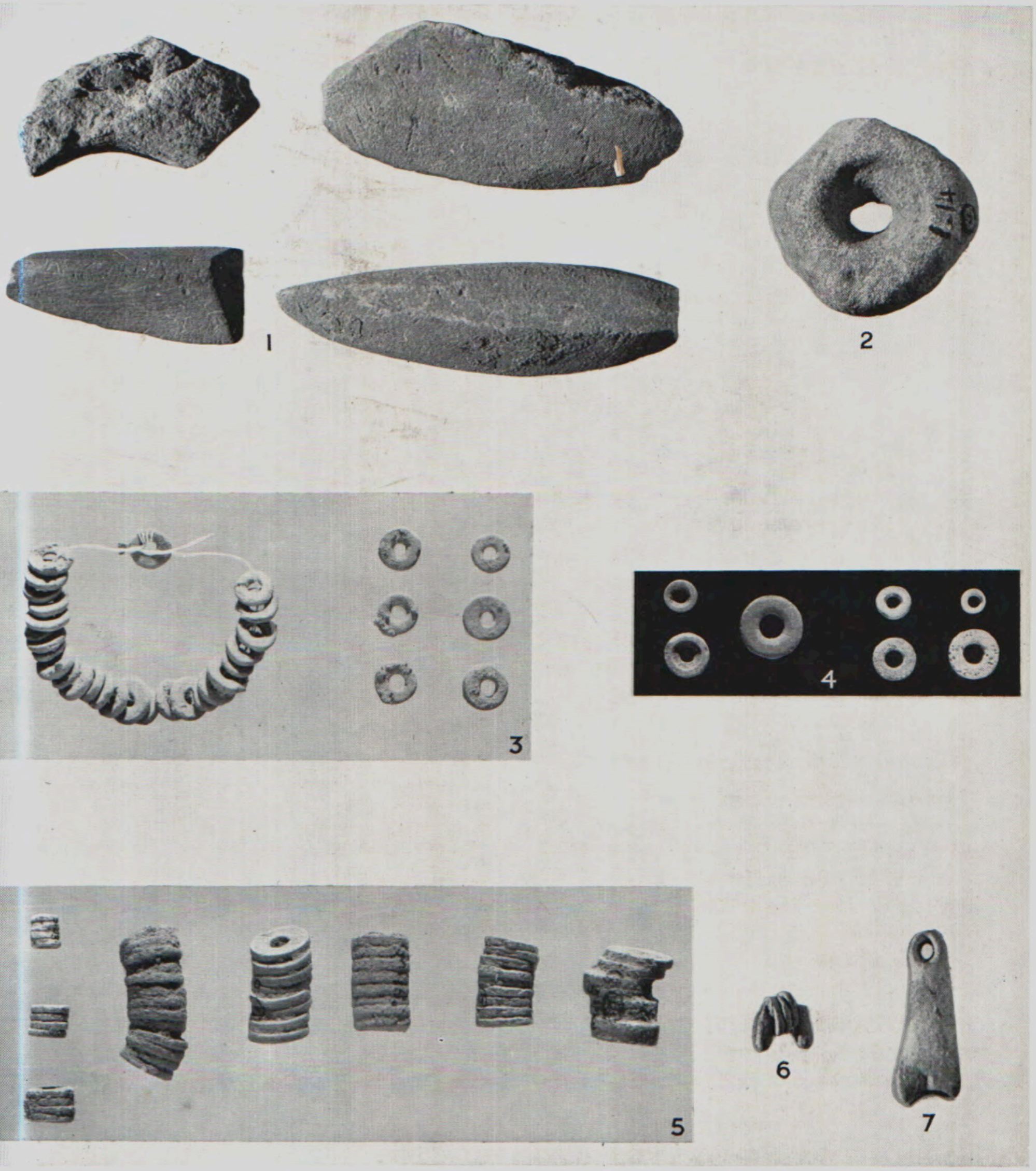
One phalanx of a small antelope (cf. *Ourebia* sp.) with a hole bored through the distal articular end, possibly for suspension, was found on the surface of the site (Pl. 9, Fig. 7). This bone could have been worn for reasons of magic, to give the wearer some characteristic quality of the animal from which it came, such as the furtiveness and skill at concealment shown by the oribi.

The perforated fish-bones (Pl. 54, Fig. 3) mentioned on p. 78 may have been used as pendants in a necklace, especially as the processes at the proximal ends of the bones have not been removed.

The lower parts of two small pendants, possibly of bone but probably perforated teeth, were found cemented with kankar to three disk beads of ostrich egg-shell. The upper part of each pendant, probably the crown of the tooth, has broken away in each case at the same place and is missing (Pl. 9, Fig. 6).

Part of a thin roughly rectangular bone pendant with rounded corners and decorated along the edge with a border of groups of three incised lines slanting alternately to right and left was found in square O 20. The fragment measures 62 × 19 mm. It recalls the larger rectangular slate palettes of predynastic Egypt, but from the amount of kankar adhering to it when found there seems every reason to think that this decorated bone pendant was contemporary with the early settlement (see also p. 77 and Pl. 52, Fig. 3).

When the very disturbed condition of the site and the skill of the early inhabitants in working bone shown by the barbed spear fragments, &c., is considered, it is reasonable to expect that decorated bone pendants and other ornaments may have been made, and when a less disturbed site of this culture is excavated it will not be surprising if some are found. (Decorated fragments of bone that may come from bone hair-pins, and which may possibly be contemporary with the early settlement, are described on p. 77 and figured on Pl. 52, Fig. 4.)



PERSONAL DECORATION

White pigment, beads, and bone pendants

1. Lumps of white pigment shaped by rubbing.
2. ? Bead of sandstone.
3. Ostrich egg-shell disk beads from early burial M 20 (2).
4. Disk beads from the early settlement—(L) three of ostrich egg-shell, (R) four of *Ampullaria* shell.
5. Groups of ostrich egg-shell disk beads as strung, cemented together with kankar.
6. Two perforated ? teeth (broken) cemented with kankar to three ostrich egg-shell disk beads, as strung.
7. Perforated phalanx of a small antelope.

SCALE 1 : 1

CHAPTER VI

THE STONE IMPLEMENTS

MATERIALS

THE small water-worn quartz pebbles that abound in certain layers of the Nubian Sandstone provided the main raw material for the stone tools of the inhabitants of the early Khartoum settlement. These pebbles can be found in many parts of the northern Sudan in large numbers where they have weathered out of the rock, and they occur in quantity within a few miles of Khartoum to the north-east on the east bank of the Nile, and also near Omdurman and in many other places on the west bank. They vary in size, but are rarely more than 2 in. in diameter—a very typical form is a spheroid of about 1 in. in diameter. Thousands of these quartz pebbles were found on the site both unworked and in every stage of working. The inhabitants, therefore, had plenty of choice within the limits imposed by the difficult nature of quartz.

The largest quartz artifact is 43 mm. (just over $1\frac{1}{2}$ in. long) and it is unique. Only a limited number are as much as 35 mm. long. For implements over $1\frac{1}{2}$ in. long the inhabitants mainly used rhyolite, for which they had to go 50–60 miles north to the vicinity of the Sixth Cataract. The rhyolite of this area has its own peculiar characteristics and can be identified by the geologist with certainty. It is hard and not easy to work, but its flakes have very sharp edges and owing to their hardness maintain their sharpness well.

From the same area they brought water-worn pebbles of gneiss for use as hammer-stones. For grinders, rubbers, &c., they used sandstone, both silcrete, ferricrete, and ferri-silcrete, which they obtained from one of the Nubian Sandstone areas mentioned above. The Merkhiyat hills just behind Omdurman are the most likely source; and it is not imagined that the people would have had any difficulty in crossing the river. There is no reason to think that the ambatch (*Herminiera elaphroxylon*) did not then grow in the neighbourhood of Khartoum. It has been used for rafts from Predynastic times to the present day.

Other materials occasionally used were fossil wood and mudstone from the Nubian Sandstone, basalt, granite from the Sileitat hills north of Khartoum, and pebbles of agate, carnelian, and jasper from the Blue Nile gravels. Two or three crescents are made of flint which must have been imported, possibly from the river Atbara.

GENERAL CHARACTERISTICS OF THE INDUSTRY

The majority of the implements made from quartz pebbles are small in size, but some of the crescents, scrapers, and other larger less typical tools are of similar size to such implements in the Upper Palaeolithic. The general characteristic of the industry is microlithic. Micro-burins do not occur, probably because the micro-burin technique was not necessary, the flakes which were obtained from the spheroid quartz pebbles being naturally crescentic and not long enough to allow the wastage of a piece from each end.

Crescents are the most common implement in the assemblage, and they shade into scrapers made on the bulbar end of flakes, both in quartz and rhyolite. A certain proportion of the crescents must have had a dual purpose, being used both as knives and scrapers. Some of the narrow crescents are very much elongated, and many of them are stout in proportion to their breadth, and are perhaps better described as backed blades, although they are not true blades. A score of these elongated crescents have an angular back, and are indistinguishable from what Vaufrey calls *pointes scalènes* in

his description of the Capsian. There are also about double that number of what Vaufrey calls *triangles scalènes*.

There is also a small and not very uniform group, including Vaufrey's *triangles* and *trapèzes* and crescents, in which markedly more than half the circumference is backed while the cutting-edge is very straight. The artifacts in this group appear probably to have been used as chisel-type arrow-heads, which remained in use in Ancient Egypt until well into the Dynastic period.

Borers both doubly backed throughout their length and also with a more or less sharp point worked on a flake occur.

Burins are rare and always atypical.

In addition to the scrapers on backed flakes already mentioned there are in rhyolite a varied assortment of scrapers none of which are typical, and among which hollow scrapers are surprisingly rare (in view of the well-made bone spear-points).

In rhyolite there are also a number of flakes with crudely faceted butts from cores with roughly prepared platforms, utilized flakes, and fabricator flakes.

1. CRESCENTS

(Pl. 10, 11, and 13, Figs. 1–16)

Some 500 undamaged specimens were collected, of which 90 per cent. were quartz and almost all the remainder were rhyolite, while basalt, chert, flint, mudstone, agate, and jasper were used occasionally. Many damaged and broken fragments of crescents were also found. Examples range in length up to 55 mm. and in breadth up to 28 mm. in rhyolite, and in quartz up to 43 mm. in length and 19 mm. in breadth, but the commonest size (usually in quartz) is about 20 mm. long and 10 mm. broad.

Specimens in which traces of the bulb remain are almost, but not quite, as common as those in which all trace of the bulb has been removed. Where the bulb has been removed the tips or points are usually of equal thickness, but where the bulbar extremity of the original flake remains, one point is usually markedly thicker than the other, and looked at from the back the crescent is often out of the straight.

Dorsal ridges occur in about a third of the specimens.

In general form the crescents are somewhat elongated, while over sixty are long and narrow, averaging 16 mm. in length and 5 mm. in breadth.

A few of the crescents have been carefully worked to a fine point at one or both ends, indicating that the ends were used for boring as well as the edge of the crescent for cutting. For an extreme case see Pl. 14, Fig. 5.

Some elongated crescents occur with the trimming at each end but not in the centre of the back, viz.:

3 examples in rhyolite ranging from 25 to 48 mm. in length, and from 12 to 24 mm. in breadth.
12 examples in quartz ranging from 17 to 32 mm. in length, and from 7 to 17 mm. in breadth.

Ten other more rounded and thicker crescents, backed at the ends only, seem to be chisel-type arrow-heads, with which they are included (Pl. 12, Fig. 9, and Pl. 15, Figs. 1–4).

Backed blades (Pl. 12, Figs. 1–3, and Pl. 13, Figs. 18–23)

Almost merging into the long and narrow crescents of small size averaging 16 mm. in length and 5 mm. in breadth described in the preceding paragraph are 145 long and narrow-backed blades, so described for the curve at the back comes rather at one end than at the middle. Many of them are proportionately stout, and the backing is more uniform and carefully executed than in many of the ordinary crescents. A few of these backed blades are carefully worked at one end, while the other end appears to have been left unfinished on purpose (Pl. 13, Figs. 18–19).

Pointes scalènes (Pl. 12, Fig. 5, and Pl. 13, Figs. 24–5)

Twenty examples varying in length from 16 to 33 mm. have a definite angle in the back towards one end and an invariably straight cutting-edge. They are carefully made, and it is not clear whether their shape is purposive or accidental due to the original shape of the pebble from which they were made, a small proportion of the quartz pebbles in the Nubian Sandstone being rounded but angular rather than spheroid. Compare Vaufrey's *pointes scalènes* in his description of the Capsian (1933, p. 471).

Triangles scalènes (Pl. 12, Fig. 6, and Pl. 13, Figs. 26–8)

Shading into the foregoing class of *pointes scalènes* are about forty small implements which are apparently the same as Vaufrey's *triangles scalènes*. They range in length from 14 mm. to 25 mm. long, a few smaller examples being probably broken specimens possibly re-used. These implements all have an angular back in which the angle is usually at or near the centre and is commonly obtuse, being never less than a right angle. The flakes from which they are made are comparatively thin.

Chisel-type arrow-heads

About a dozen examples (the three smallest of carnelian and the rest of quartz) were found, in which the two backed sides met at an acute angle; see Pl. 12, Fig. 7, and Pl. 15, Figs. 7–8). The length of the cutting-edge ranges from 7 to 15 mm., and from back to front the length varies from 7 to 15 mm. also. These implements are of the type called *triangles* by Vaufrey.

Possibly with them should be included another dozen larger quartz crescents which have a more or less angular back, and of which the cutting-edge ranges in length from 20 to 30 mm. These may well be, however, only crescents whose shape has been affected by the shape of the pebble from which they were made.

The *triangles* shade into a series of twenty-five implements which have two trimmed edges at an angle to each other, prevented from meeting by a rough side opposite and more or less parallel to the straight cutting-edge. This rough back is sometimes trimmed. Here again the smallest examples are of carnelian or agate, and the remainder of quartz. For examples see Pl. 12, Fig. 8, and Pl. 15, Figs. 5–6. The length of the cutting-edge ranges from 6 to 20 mm., and the depth of the implement from back to front ranges from 5 to 20 mm. These implements resemble the type described by Vaufrey as *trapèze*.

When the rough back is carefully trimmed and rounded, and the trimming prolonged towards the point, the *trapèze* type shades into a special form of crescent or trapezoid, which was also probably used like both the previous types as a chisel-type arrow-head, of which the use continued in Ancient Egypt down to Dynastic times. Examples of these round-backed arrow-heads may be seen in Pl. 12, Fig. 9, and Pl. 15, Figs. 1–4. One exceptionally large example in rhyolite has the cutting-edge 23 mm. long and measures 20 mm. from back to front. Most of the remaining thirty-eight examples are of quartz, with a few small examples of carnelian and agate. Several of the medium-sized quartz examples have exceptionally thick backs. The length of the cutting-edge ranges from 7 to 20 mm., while the depth of the implement from back to front ranges from 5 to 15 mm. (Only the more or less perfect specimens have been taken into account, and twenty crude damaged or unfinished specimens have been excluded.)

Six medium-sized quartz examples which have a point at each end of the cutting-edge created by deliberate hollowing out or scalloping of the back just behind the cutting-edge are presumably a variety of the foregoing type, than which they would be more efficient; for the hollowing out would enable the cutting-edge to extend beyond that part of the arrow-shaft in which the stone head was embedded, increasing both the cutting area and the strength of the arrow-head. Average length of

cutting-edge 18 mm. and of implement from back to front 12 mm. For examples see Pl. 14, Fig. 1, and Pl. 15, Fig. 12.

There are also ten examples of thick rounded crescent (eight examples in quartz ranging in length from 14 to 26 mm. and two in agate 18 and 20 mm. in length) in which the backing occurs only at each end of the back (Pl. 12, Fig. 4). These also were no doubt used as chisel-type arrow-heads.

We may now perhaps mention a small group of approximately rectangular quartz flakes 7 to 8 mm. in breadth which have the back parallel to the cutting-edge backed, and the ends, which are at slightly less than a right angle to the cutting-edge, also backed (Pl. 14, Fig. 2). The length of the four best examples ranges from 18 to 24 mm. Four smaller and rougher examples range in length from 11 to 12 mm. At first sight these looked like 'sickle teeth', but as there is no polish on the cutting-edge or evidence that the inhabitants of the site cultivated grain or even gathered grass seed, it is unlikely that they were used in sickles.

2. BORERS

We have already mentioned under crescents examples of the latter which have at least one end of the crescent worked to a point probably with the intention of using it for boring as well as cutting. Sixteen examples in quartz ranging in length from 16 to 30 mm. and all more or less atypical may be seen in Pl. 14, Fig. 5.

Four other atypical borers are backed on one side only. They range in length from 17 to 23 mm., and may be unfinished examples of the following.

These are quartz borers of 'slug' shape that are typical of the South African Wilton (Breuil, 1931, fig. 56), and which occur rarely in the Capsian (see Vaufrey, 1933, fig. 10). Fifty-four complete examples were found and about twenty broken pieces. See Pl. 14, Fig. 4, and Pl. 15, Figs. 9–11. One unique example is 38 mm. long by 13 mm. maximum breadth (see Pl. 15, Fig. 9). The remainder range in length from 13 to 27 mm.

Another type of borer consists of a more or less finely worked point worked on to a rough fragment of a flake or very rarely of a core, in either rhyolite or quartz. These borers are related to the foregoing more typical 'slug' borers, for they are trimmed on two sides of the point, and almost always have the underside flat. One example in mudstone has a fine point one end and a coarse point the other. There are ten examples in rhyolite, one in fossil wood, and twenty-seven in quartz; see Pl. 14, Fig. 6. A number of crude borers in both quartz and rhyolite are not included in the above.

Six thick flakes of rhyolite ranging in breadth from 30 to 50 mm. have been crudely backed on two more or less parallel edges by reverse retouch, i.e. one side has been trimmed from the upper face and the opposite side from the lower face. But these flakes have no points and may have been used as reamers. Six other thick elongated pieces of rhyolite ranging in width from 8 to 12 mm. and in length from 20 to 37 mm. have been trimmed on two opposite edges and may also have been used as reamers.

Five small partly worked quartz pebble cores have been worked into a point, on a naturally flat side where the outer cortex has been left, by striking a number of flakes away from this cortex-covered flat side. The point so formed could have been used for boring.

3. SCRAPERS

A total of 418 scrapers was found, most of them crude, and none of them belonging to a very definite type except the scrapers made on the bulbar end of the flake. As already mentioned, the crescents merge into scrapers in this industry, and it is at times difficult to decide into which class an implement

should be placed. Where there was any doubt as to whether the implement was a scraper or not, it has been included under the crescents when also possessing the characters of a crescent; and it is certain that some so included were also used (along the backed edge) as scrapers as well as being used as cutting-tools (along the opposite edge).

A number of implements that might have been included with the crescents, from their shape, but which have no doubt been used as scrapers, because they have fine step flaking along one or both edges of the side that has been backed, are included here with the scrapers. They are:-

Rhyolite: bulb present: range from 26 to 53 mm. in length: 39 examples.
Rhyolite: bulb removed: range from 23 to 55 mm. in length: 26 examples.
Quartz: ranging from 15 to 32 mm. in length: 24 examples.

With them should perhaps be included twenty-two quartz crescent-like scrapers which are worked all along one edge at the back but fully backed at one end only. They range in length from 15 to 29 mm. A very few rhyolite examples also occur (Pl. 20, Fig. 2, and Pl. 21, Figs. 10–12).

The other scrapers may be analysed as follows:

(*a*) Scrapers on bulbar end of flake.
(*b*) Scrapers on side of flake.
(*c*) End-scrapers.
(*d*) Hollow scrapers.
(*e*) Core scrapers.
(*f*) Atypical scrapers.

(*a*) *Scrapers on bulbar end of flake*

1. Used on one side only (Pl. 17, Fig. 1). These are flakes which have been more or less crudely backed at the bulbar end and show step-flaking along one edge of the backing where used as scrapers. The opposite edge of the flake is irregular and blunt, not straight and sharp as in the crescent. Thirty-seven examples in rhyolite ranging in length from 23 to 52 mm. Seven examples in quartz and one in chert, all about 19 mm. long.

2. Used on both sides of the backed end (Pl. 17, Fig. 2). These are flakes similar to the above which show step-flaking along both edges of the backing. Seven examples in rhyolite range from 27 to 48 mm. in length, and two examples in mudstone are both 31 mm. long.

3. Straight or square-ended scrapers on the bulbar end of a flake (Pl. 17, Fig. 3). These have the butt at the bulbar end trimmed all over its face, with minute step-flaking along the edge that has been used as a scraper. The flakes were no doubt struck from straight-sided cores. Thirteen examples in rhyolite with the length of the scraper edge ranging from 21 to 40 mm.

(*b*) *Scrapers on side of flake*

1. With bulb of percussion not removed (Pl. 18, Fig. 1, and Pl. 21, Figs. 6–8 and 11). Thirteen examples in rhyolite. Most of these are flakes which have been trimmed along one side instead of at the bulbar end of the flake. The trimming and minute step-flaking is similar to that in class (*a*) above. In two examples the flake has been further shaped by the trimming being carried round the distal end of the flake, and while the trimmed side is thick, the opposite side has been given a thin cutting-edge by the removal of a transverse flake (Pl. 18, Fig. 3, and Pl. 21, Fig. 6). In one example this cutting-edge has been further trimmed from both sides. In one atypical example the flake has plunged, and has then been trimmed along one edge of its concave side. Length ranges from 30 to 44 mm.

One example in mudstone; length 17 mm.

One example in flint from layer 100–20 cm. in square M 20; length 31 mm.

Twenty-nine examples in quartz ranging in length from 19 to 39 mm., the most usual length being

about 25 mm. These have been struck from a spheroid quartz pebble and the trimming is along the side of the flake that retains the natural curve of the pebble. In the majority of cases some of the external cortex remains (Pl. 18, Fig. 1).

2. With bulb removed. Ten examples in rhyolite (Pl. 16, Fig. 4). These are rough fragments of flakes, which have been trimmed along one of the longer sides. Minute step-flaking along at least one edge of the trimming shows that they have been used as scrapers. Length ranges from 24 to 44 mm.

Thirty-two examples in quartz, ranging in length from 14 to 29 mm. (Pl. 18, Fig. 2). These have been trimmed along the edge of the flake that retains the natural curved shape of the pebble. In many cases much of the cortex remains on the flake. They differ from class (*b*) 1 in having had the bulbar portion of the flake broken away.

3. Straight-sided scrapers (Pl. 18, Fig. 4). Eleven examples in rhyolite ranging in length from 22 to 51 mm. These are rough flakes of varying thickness, one side of which is straight rather than curved, and has been trimmed and sometimes minutely step-flaked as well.

Six examples in quartz ranging in length from 14 to 23 mm. They are rough flakes which have one edge more or less straight, and which has been trimmed as above.

(*c*) *End-scrapers* (Pl. 19, Fig. 1, and Pl. 21, Figs. 13–14)

1. Seven examples in rhyolite, all atypical, made on rough flakes of some thickness, ranging in length from 27 to 68 mm. The trimming is limited to one end, where the cutting-edge is narrow and rounded, and ranges from 10 to 20 mm. across. Other very roughly trimmed flakes of similar shape occur and may have been used for the same purpose.

Six examples in quartz show trimming at one slightly rounded end of rough more or less thick flakes which range in length from 17 to 33 mm. The cutting-edge ranges from 8 to 14 mm. across.

2. Two examples in quartz show trimming along one lateral edge as well as on one slightly rounded end. One is 11 mm. long and 7 mm. wide, and the other 25 mm. long with the end cutting-edge 11 mm. wide.

3. Scrapers on plunging end of plunging flake (Pl. 21, Figs. 15–16). Eleven examples in rhyolite, in which all but three show the bulb of percussion of the flake which plunged. The trimmed cutting-edge is along the distal end of the flake, where the plunging gave it a natural cutting-edge. One or two examples are trimmed along one or both external edges of the flake as well as along the plunging end. Most of the flakes are as they came from the core with the exception of the trimmed cutting-edge. Pl. 21, Fig. 16 resembles Vaufrey's fig. 6 (1) from the Capsian except that it is less than half the size.

(*d*) *Hollow scrapers* (Pl. 19, Figs. 3–5, and Pl. 21, Figs. 17–18)

1. Ten examples in rhyolite are all crude and atypical. The notches are situated haphazard on flakes of rhyolite or quartz, and are trimmed with shallow retouch and sometimes with step-flaking as well. The length of the notches ranges from 9 to 30 mm., the average being 16 mm.

A number of other rhyolite flakes have rough notches which have been utilized and some of which show crude step-flaking.

One quartz flake from conventional layer 120–60 cm. in square M 24 has a trimmed notch 10 mm. in length, and four other quartz flakes have notches of similar size that appear to have been utilized.

2. Six rhyolite crescents or crescent-like scrapers have roughly trimmed notches in the edge opposite the side that is backed: see Pl. 19, Fig. 4.

3. Seven rhyolite and one mudstone examples of flakes that have been backed on the bulbar end (cf. class (*a*)) have had a flake struck from the backed edge, and the edge of the scar so made has been used as a kind of hollow scraper, as is evidenced by fine retouch or step-flaking. The length of this scar ranges from 15 to 30 mm. (Pl. 19, Fig. 5).

4. Nine cores of rhyolite show traces of use as hollow scrapers with step-flaking along the edge of the bulbar scar, where a deep flake has been removed from the core.

(*e*) *Core scrapers*

Sixteen examples in rhyolite are all crude and irregular. They show step-flaking along one edge which is roughly at right angles to an original flat face of the core. In all but four examples the scraper edge is straight, ranging in length from 20 to 70 mm. In the other four examples the cutting-edge has been rounded with rough trimming, and is from 13 to 25 mm. across.

Twenty-one examples made from quartz pebble cores are also irregular and atypical. They show step-flaking along a worked face of the core at right angles to a flat natural face of the pebble, and the cutting-edge is usually to some extent rounded. In an average example the cutting-edge is approximately 25 mm. across (Pl. 20, Fig. 1).

(*f*) *Atypical scrapers*

1. Three backed crescentic scrapers of quartz show some trimming along the edge of the flake opposite the backed side. They are thus a kind of double scraper.

2. Seven rough flakes of rhyolite and one of mudstone show rough trimming of two opposing edges from alternate sides of the flake.

3. Eighteen flakes of rhyolite (some thick) and one of mudstone show trimming along one edge and have probably been used as scrapers. All, however, are irregular, no two being similar. The length varies from 25 to 60 mm.

4. BURINS

(Pl. 15, Figs. 13–16, and Pl. 20, Figs. 3–4)

Burins are rare and all atypical. Made of rhyolite and of an average length of about 50 mm., there are only seven examples, and some of them may have been accidental.

Twenty-eight examples besides some doubtful ones are made from small quartz pebbles, and range in length from 18 to 32 mm. Some are made on sections or fragments of pebble on which the cortex remains, the blow or blows making the burin being struck from the cortex-covered surface (ten examples). Three are made in the same way on nail-like pointed splinters of quartz which retain the original cortex of the pebble on the 'head of the nail'. Fourteen examples are made on rough more or less narrow and thick flakes, where they have been broken across towards the distal end. On these flakes the bulb is visible. Only one example was noted of a burin made on the bulbar end of a flake.

A few quartz pebble cores could have been used as burins, and should have been effective tools in making barbed bone spear-heads. A number were submitted to Dr. L. S. B. Leakey, but he considered them to be only 'reasonably typical Wilton type cores, in which the flaking has not run very satisfactorily'. A number of burins were also submitted to Dr. Leakey, and it is on his advice that they are classified as all atypical. He commented that they were 'of a variety of types, all more or less atypical but of a sort that occurs in assemblages of the Wilton type. None of them are true angle burins, but a few are of the *bec-de-flute* type, though not sufficiently characteristic to be called by that name.'

5. UTILIZED FLAKES

(Pl. 22, Figs. 1–2)

Many rhyolite flakes and fragments which cannot be assigned to any tool types showed definite utilization and sometimes slight retouch. A number show on the crest of a ridge a battered utilization and are regenerating flakes from pebble fabricators (see below, p. 49). Four thick flakes with one or more battered edges were presumably used like pebble fabricators for backing.

A number of elongated flakes from quartz pebbles show evidence of utilization at one end.

Eight examples of stocky nail-like quartz flakes show traces of marked utilization at one end, possibly as borers. They range in length from 20 to 28 mm. Two were found together in conventional layer 100–20 cm. in square M 20; others came from conventional layers 100–20 cm. in square M 26 and 90–110 cm. in square M 27.

6. FLAKES FROM CORES WITH PREPARED PLATFORMS.
(Pl. 22, Fig. 3)

Eighty-six flakes of an average length of 40 mm. with faceted butts, indicating that they were struck from cores with prepared platforms, were recovered. The majority are of rhyolite, a few of ferricrete sandstone, and two of quartz. These flakes are of all kinds of irregular shapes. Some were no doubt utilized as rough knives and others rejected as waste flakes. Many of the smaller waste flakes from the small quartz pebble cores also have roughly faceted butts, but in most cases they do not seem to have been used.

Four thick flakes of rhyolite with faceted butts ranging in length from 35 to 50 mm. show some rough retouch and were no doubt used, but cannot be classified as any particular type of tool.

Eight short stout flakes of rhyolite ranging in length from 15 to 30 mm. with faceted or roughly trimmed butts show considerable burring and/or step-flaking of the edge of the butts, indicating that they were probably used as fabricators.

7. CORES
(Pl. 23)

Cores of rhyolite, which had to be fetched 50–60 miles from the Sixth Cataract, are to be numbered in hundreds, and when suitable for artifacts were no doubt often worked until too small for any further use. Cores made from the small water-worn quartz pebbles from the Nubian Sandstone, which could be found at a short distance from the site, were, however, to be numbered in thousands. Many had had only one or two flakes struck from them, and a proportion of them were still unused.

Of these small quartz cores many had a striking platform prepared by removing one or two flakes from one face, and then striking off a number of flakes at right angles to the surface first prepared. Some of these cores could have been used as burins, see p. 47 above.

One type of core scraper made from these small quartz cores has also been noted above (p. 47). In a few quartz pebble cores a number of flakes have been struck from all sides except one fairly flat side where the outer cortex remains. From the edge of this cortex-covered side a number of flakes were struck which only ran about 5–6 mm. and then broke off. This left a cutting-edge which may have been utilized. On one example there is some red ochre embedded in the groove formed by these deep step-flakes, suggesting that these cores may have been used for grating lumps of red ochre into powder. This type of core only numbers about a dozen, but since quartz cores were very plentiful, it is difficult to understand why they were persevered with when the flakes would not run, unless a special type of cutting-edge was intended. A similar type of core is figured second from the left in the bottom row of fig. 56 illustrating a Wilton assemblage from Still Bay in South Africa (Breuil, 1931).

About twenty small quartz pebble cores might be regarded as pygmy pebble tools of a chopper type, but it is more probable that they are only partly worked cores.

The rhyolite cores are all irregular, and have had flakes struck from them in all directions. No principle is apparent, other than where possible to prepare a crude striking platform by removing one or two flakes in one direction to give a flat surface, and then striking off a number of flakes at right angles to the flat surface. This was not, however, confined to any particular part of the core,

with the result that cores are all irregular and impossible to type. Cores similar to these rhyolite cores also occur in ferricrete sandstone, fossil wood, basalt, and gneiss.

Some of the rhyolite cores have an edge or two to some extent burred or battered, due presumably to the core having been used as a fabricator for backing. When such a core has been regularly used as a fabricator, it enters the class of pebble fabricators, now to be described.

PEBBLE FABRICATORS

(Pl. 15, Figs. 17–18, and Pl. 24)

Among the very many pebbles and other pieces of stone, all of which must have been brought by the inhabitants to this river-side site on a clay-cemented sand where no stone is natural other than small kankar concretions, it was possible to distinguish a particular kind of hammer-stone of a roughly flattish oval shape, which had apparently been flaked usually along one or both of the longer sides (or all round except for one end) in order to give it a roughly sharpened edge, unless it happened to possess such an edge naturally. In rare examples this artificial edge goes all round the pebble. This edge usually shows marks of hammering or burring; and in a typical well-used specimen there is a line of such burring all round the circumference of the hammer-stone, or pebble fabricator as I prefer to call it. For in 1941, when I was first taking an interest in this site, I took a few objects from it to Kenya including one of these tools, and when the late Archdeacon W. E. Owen saw it, he at once said that he was sure that backed blades or lunates would be found on the site, for in Kenya he always found this type of hammer-stone associated with backed blades and lunates, and in his opinion (which I now share) this tool was that with which the backing was done.

The material of which these fabricators are made is usually rhyolite or blue gneiss, the rhyolite certainly coming from the Sixth Cataract about 50 miles to the north, and the blue gneiss usually in the form of water-worn pebbles in the opinion of the Government Geologist probably coming from the same area.

Examples of these pebble fabricators are shown on Pl. 15, Figs. 17–18, and Pl. 24. The average dimensions of the nine most regular examples are maximum length 61 mm., maximum width 52 mm., and maximum thickness 28 mm. Of these examples seven were rhyolite and two gneiss. The smallest example M 28 (10) came from conventional layer 120–40 cm. It is of ferricrete sandstone, maximum length 46 mm., maximum width 40 mm., and maximum thickness 17 mm.

Some examples were found in which the ends of the pebble were scarred by hammering, but the artificially flaked edge showed very little or no burring. It is probable that these were fabricators in which the edge had been freshly reconditioned; but some few may only be rough cores never intended as fabricators, although it appears probable that cores of rhyolite, from which flakes for tools had been struck, were sometimes used as pebble fabricators, on happening to reach approximately the right size and shape.

Including a few of these doubtful specimens, the proportion of rhyolite to gneiss and other materials used for these pebble fabricators is shown in the following table:

	Typical examples	*Rough examples*	*Doubtful*
Rhyolite	14	20	15
Blue gneiss (originally all water-worn pebbles)	5	16	..
Ferruginous and other gneiss	2	8	3
Quartz	1	..	..
Ferricrete sandstone	2	2	1
Silcrete sandstone	..	3	2
Mudstone	..	..	1

The mudstone example is too soft to have been of any use for backing quartz or rhyolite blades, and probably the same applies to the silcrete sandstone examples.

Gneiss is tougher than rhyolite and does not scar so easily; and probably to be included with the above are ten roughly flattish oval water-worn pebbles of gneiss (eight blue gneiss), nine of which have had one side crudely flaked to give a rough edge, and one has two edges so flaked.

One of the above regular flat oval pebble fabricators of blue gneiss, the ends and two flaked edges of which show traces of burring, has one flat side, which is smooth and to a certain extent polished, perhaps from being used for grinding ochre (see below).

Two typical rhyolite pebble fabricators came from the following conventional layers, viz. 160–80 cm. in square M 28 (Pl. 24, Fig. 1), and 140–80 cm. in square M 29.

HAMMER-STONES

(Pl. 25, Figs. 1–2)

Presumably not really functionally separated from the pebble fabricators just described are a number of spheroid (and more rarely cuboid) pebbles which show traces of hammering, particularly where they happen to have some kind of a prominent edge which may be either natural or artificial. These pebbles vary in diameter from 46 to 77 mm. They include:

38 of blue gneiss
9 of ? ferruginous gneiss
1 of rotten acid gneiss
1 of rhyolite
1 of rotten vein quartz or chert
3 of silcrete sandstone
3 of ferricrete sandstone
3 of fossil wood.

Examples were found in the following conventional layers:

80–100 cm. in square M 25
90–100 cm. ,, ,, M 26
110–20 cm. ,, ,, M 23
170–90 cm. ,, ,, M 29
200–20 cm. (2) in square M 30.

Five smooth water-worn pebbles which had definitely been used as hammer-stones at either one or both ends were found on the site, although it is uncertain whether they belong to the earliest inhabitants. They are of rhyolite (1), basic gneiss (1), veined quartz (1), and silcrete sandstone (2), and are on the whole smaller than the above, their maximum diameter varying from 45 to 62 mm. Quite a number of small water-worn quartz pebbles from the Nubian Sandstone (maximum diameter about 30–5 mm.) show traces of hammering, particularly at the ends, and are presumably contemporary with the early settlement.

GRINDERS

Pebbles with one or more polished faces

A considerable number of spheroid blue gneiss pebbles (probably originally water-worn) showed signs of polishing on one to three faces.

Thirteen examples varying in maximum diameter from 47 to 81 mm. can only be distinguished from the thirty-eight blue gneiss pebbles described above as hammer-stones, in that in addition to being used as hammer-stones they have also been to some extent used as grinders as well.

The above shade into a more regular spheroid type which has a flat side markedly polished (presumably in grinding ochre—see below), see Pl. 25, Fig. 2. There are five examples of irregular shape (all of blue gneiss); a group of three rather more regular spheroid blue gneiss pebbles, each with one definite smooth face, which all came from conventional layer 160–80 cm. in square M 28 (Pl. 25, Fig. 3); and seven regular spheroid examples (four of blue gneiss and three of ferruginous gneiss). The latter all show traces of wear, due to hammering (or coarse grinding) round the major circumference, and are to be compared with examples in other materials, some of which show traces of ochre on the polished face (see p. 52).

Six other examples in gneiss show some artificial roughening of the polished face, presumably intended to produce more efficient grinding, the smoothness being presumably produced by grinding the ochre to a final very fine stage and in itself being inimical to efficient grinding.

Then there are six irregular gneiss pebbles which all show a slight concavity in the smooth face, possibly produced by repeated pitting and grinding. The most regular of these came from layer 140–60 cm. in square M 28.

Eight spheroid gneiss pebbles have one smooth face and an apparently artificial concavity on a face more or less opposite the smooth face, and in four cases the smooth face has been artificially roughened as well.

Eight spheroid gneiss pebbles show two polished faces, as does one of rhyolite.

One similar gneiss pebble shows pitting on both polished faces, another has pitting on one of its two smooth faces, and two have each one of their smooth faces somewhat concave.

Four water-worn blue gneiss pebbles with a roughly triangular cross-section have all three faces somewhat smoothed. In one example two of the faces are somewhat hollowed, in another all three of the faces are somewhat hollowed, while in a third one of the three smooth faces has been artificially pitted.

Differing apparently only in material from the gneiss pebbles with polished faces just described are a few spheroid pebbles of silcrete sandstone each with one face to some extent polished by wear. Seven such pebbles vary in maximum diameter from 55 to 65 mm. Three others show some artificial pitting of the smooth face.

Five spherical rubbers of silcrete sandstone with no polished surfaces and varying in diameter from 40 to 55 mm. probably would have developed at least partial keels with more wear as in the following class. One of them, No. 11 from conventional layer 200–20 cm. in square M 28, has the faint suggestion of a keel.

Pebble grinders with some traces of a keel

Eighteen spheroid pebbles show traces of a keel round at least part of their major circumference. Above and below the keel there is usually evidence that the pebble has been used for coarse grinding, for though regularly worn it is still rough and not polished in any way, and the keel must have been produced artificially at the intersection of two faces used for grinding. Such pebbles vary in maximum diameter from 52 to 75 mm. and are usually more or less regular flattened spheroids, although more irregular shapes due to the use of water-worn pebbles do occur. Materials used were blue gneiss, ferruginous gneiss, silcrete sandstone, ferricrete sandstone, and granite.

Pl. 25, Fig. 4, and Pl. 27, Fig. 1, show K.H. 72, an example in silcrete sandstone in which the keel goes almost all round. In others the keel may be of similar extent, or go half-way round the circumference only, or be only just apparent for a short extent. In addition to gneiss and sandstone two or three examples were of granite or of stone of a granitic nature.

The keeled pebble grinders so far mentioned have no smooth polished faces, but the following have both keels or traces of keels and one or two polished faces:

3 spheroid blue gneiss pebbles (maximum diameter 70 mm.).

5 flattened spheres of silcrete sandstone with one flat polished face (see Pl. 25, Fig. 5, and Pl. 27, Fig. 2, for one example, K.H. 69).

6 spheroid examples of silcrete sandstone with traces of a keel and one slightly polished face; maximum diameter from 45 to 55 mm. (see Pl. 25, Figs. 6 and 6A).

2 spheroid examples of silcrete sandstone with traces of a keel and one definitely polished face; depression on side opposite face, probably artificial and intended for thumb grip. Maximum diameter 55 to 60 mm.

That the grinding which produced these keels was done in producing powdered pigment out of pebbles of yellow and red ochre (for which see p. 37) is indicated by the presence of pigment still remaining on certain of these grinders.

Grinders stained with red or yellow ochre

K.H. 402 (Pl. 27, Fig. 3) is a little more than half a sphere of silcrete sandstone with a highly polished flat under surface markedly stained with yellow ochre. It has a keel round the major circumference about 15 mm. above the polished surface. The maximum diameter is 75 mm. and maximum thickness 50 mm.

R 23 (7) (Pl. 26, Fig. 1) is a much-flattened spheroid of silcrete sandstone with a maximum diameter of 65 mm. and a minimum diameter of 40 mm. More than half of the major circumference shows traces of a keel, with a fairly even but roughened surface to the curved edge for 15–20 mm. on either side of the keel. The rest of the surface consists of two comparatively flat polished surfaces, one of which has been artificially roughened, and the other is stained with red ochre.

Q 19 (404) is an irregular spheroid pebble of blue gneiss, with a smooth polished flat under surface. Around the major circumference it is regularly roughened and stained with red ochre (for grinding which it has no doubt been used) and along part of the major circumference there is trace of a keel.

K.H. 405 is half a blue gneiss pebble of maximum length 65 mm. and maximum thickness 45 mm. It has one highly polished face which is stained with red ochre.

Sandstone disk grinders stained with ochre

So far we have only mentioned hammer-stones and grinders of pebble form, usually sub-spherical.

We now come to an even more numerous class of grinders which have been made out of more or less flat slabs of silcrete sandstone with an average thickness of 25–30 mm., the most regular shapes being circular, oval, or ones with rounded ends and the long sides more or less straight. These vary in cross-section. The upper and lower faces may be flat and parallel, or occasionally flat and at an angle to each other. One face may be flat and the other slightly convex; or one face may show some concavity while the other is either flat or to some extent convex. Artificial roughening by slight pitting of the smooth face may or may not occur. In most examples the edges are approximately straight and perpendicular.

After prolonged consideration of the different varieties, and influenced mainly by the examples which have traces of red or yellow ochre still on them and which will now be described, I have come to the conclusion that this type of grinder was possibly always used for grinding ochre to powder for pigment. Certainly the smaller grinders were so used (see below).

K.H. 1310 (Pl. 27, Fig. 5) is half-way between a pebble and a disk grinder. It is of ferri-silcrete sandstone, maximum length 70 mm., maximum width 50 mm., and maximum thickness 36 mm. Of two more or less flat faces one is polished and stained with red ochre. The two long sides are more

or less perpendicular, and the two ends rounded. At one end it has been worn by being used at an angle to the lower grindstone.

K.H. 1304 (Pl. 26, Fig. 2, and Pl. 27, Fig. 4) is a circular sandstone grinder with two approximately flat faces not parallel to each other. The lower face is highly polished and stained with red ochre. It has been artificially roughened. The major circumference between the two flat faces is of a uniform roughness as in the pebble grinders R 23 (7) and Q 19 (404) already described and, as can be seen in Pl. 27, Fig. 4, it has a keel round most of it.

K.H. 418 (Pl. 26, Fig. 3) is a flattish circular disk of silcrete sandstone with a maximum diameter of 92 mm. and a thickness of 30 mm. It has traces of a keel almost all round, and the smooth underside, which is artificially pitted in the centre, shows signs of having been used for grinding yellow ochre. Two flakes have been struck from the upper (rougher) surface, the edge having probably been used as a hammer. (Many grinders will be noticed in which flakes have been struck from the edge. An extreme example is K.H. 1312 (Pl. 27, Fig. 8), a silcrete grinder of 102 mm. maximum diameter which has had a number of rough flakes struck from each face of the edge. It is not stained with ochre.)

K.H. 215 (Pl. 26, Fig. 4, and Pl. 27, Fig. 6) is a blunt oval disk of silcrete sandstone with a maximum diameter of 100 mm. and a maximum thickness of 34 mm. The upper face is slightly concave and the smooth flat underside is stained with red ochre. From this under surface a few shallow flakes have been struck, presumably when the edge was used as a hammer. Each end of this grinder shows a keel, due no doubt to it having been held at an angle to a lower grindstone during part of the grinding operations until the intersection of two grinding-faces has formed a keel.

Three other sandstone grinders that had all been originally approximately rectangular in shape, but have had their corners rubbed off and outline rounded by wear, have a similar concavity on the upper side to that in K.H. 215 and still show traces of ochre.

K.H. 436 (Pl. 26, Fig. 5) has a maximum length of 110 mm., breadth 80 mm., and thickness 45 mm. One of the long sides has had a piece broken off, possibly by being used as a hammer; and the other long side which has been used for grinding shows traces of red ochre. There is a suggestion of an incipient keel at one end.

K.H. 437 is rough in outline, possibly due to weathering. It has a maximum length of 60 mm. and thickness of 25 mm. It has a concavity on the upper face and the suggestion of a keel in one place at the side. On the smooth under surface there are traces of red ochre.

K.H. 236 is a thick oval with fairly straight edges. It has a maximum length of 60 mm. and thickness of 30 mm. There is a slight concavity in the upper face and traces of red ochre on the smooth under face. A piece has been broken off one of the longer sides.

It appears probable that these grinders, which show a concavity on the side opposite the smooth face, have obtained the smooth face through being used as upper grindstones and the concave face through being used as lower grindstones for the pebble grinders already described.

K.H. 440 is half a small thick disk of silcrete sandstone with more or less straight sides, one flat face, and one slightly convex smooth face showing some staining with red ochre. Diameter 56 mm., thickness 43 mm.

K.H. 441 is a segment (a third) of a circular disk of coarse silcrete sandstone with one flat face and one smooth convex face, both used for grinding. The smooth face is stained with red ochre. The edges have been rounded with wear.

K.H. 431 (Pl. 26, Fig. 7) is a somewhat weathered 'straight-sided oval' of silcrete sandstone which has acquired its present shape through being used as a grinder all round the edge as well as on both flat faces. Its maximum length is 95 mm., maximum width 80 mm., and thickness 30 mm. Its

smoother face is still stained with red ochre despite the weathering. There has probably been a slight artificial roughening of this smooth face.

K.H. 432 is of ferri-silcrete sandstone and has a similar outline to K.H. 431 except that one corner has been broken off anciently. The two flat faces are not parallel. Its maximum length is 88 mm., maximum width is 70 mm., and thickness varies from 32 to 24 mm. Its smoother face, which is slightly convex, is stained with red ochre and has been artificially roughened. Its rougher face, which is flat, has also no doubt been used for grinding and has in the middle a small artificial pit about 10 mm. diameter and 2 mm. deep.

K.H. 435 is of ferricrete sandstone. It also is of similar general shape to the last two, having apparently been a rectangular slab that has at some time lost one corner. Its contours have all been rounded by wear. Both of the faces are slightly convex and, particularly on one side, the thickness has been reduced by uneven wear. Both faces have been smoothed by much grinding and then artificially roughened. Both ends (in contrast to the longer sides) have also been roughened, presumably by being used for breaking up lumps of pigment. There are slight traces of yellow ochre on one of the faces and one of the longer sides. Maximum length 103 mm., maximum width 90 mm., maximum thickness (in the centre) 30 mm.

K.H. 422 (Pl. 26, Fig. 6) is a somewhat weathered 'straight-sided oval' disk of silcrete sandstone with traces of a keel at one end. Both flat faces have been used for grinding, the one which is smooth showing marked staining with yellow ochre except where it has been artificially pitted to a depth of about 2 mm. over an area of about 15 mm. diameter in the centre of the face. Maximum length 75 mm., maximum width 60 mm., maximum thickness 35 mm.

K.H. 421 and K.H. 403 are irregular disk grinders of silcrete sandstone, which may also have been used as hammer-stones, and which show traces of ochre-staining in each case on the single smooth flat face. K.H. 421—maximum diameter 70 mm., maximum thickness 35 mm.—shows traces of red ochre where the smooth face has been artificially roughened, and K.H. 403—maximum length 70 mm., maximum breadth 60 mm., maximum thickness 40 mm.—is stained with yellow ochre.

Other grinders stained with ochre

O 19 (4) is a roughly circular disk of granite from Jebel Sileitat (latitude 15° 50′ N., longitude 32° 40′ E.), of which both the flatter faces are highly polished and irregularly convex, verging on the angular, one of these faces being stained with yellow ochre. The circumferential edges are rough and appear to have been used for grinding (coarse) and hammering. Maximum diameter 60 mm., maximum thickness 33 mm.

K.H. 408 is a roughly oval pebble of silcrete sandstone with one polished angular face which is stained with red ochre. The opposite face is rough and concave. Its maximum length is 52 mm.

K.H. 433—found in conventional layer 80–90 cm. in square M 26—is an irregular piece of silcrete sandstone which has one edge semicircular and the rest of the edge irregular due to two pieces being broken off. Both faces appear to have been originally angular and to have been used for grinding, and there are faint traces of red ochre on the smoother face. Maximum length 95 mm., maximum breadth 82 mm., maximum thickness 40 mm.

K.H. 434 is a heavy lump of ferricrete sandstone with a trapezoidal cross-section. The largest face has been rubbed smooth. The other faces, which are all rough and have probably only been used for hammering, have much red ochre still on them. Maximum length 85 mm., maximum breadth 55 mm., maximum thickness 50 mm.

Sandstone grinders with a flat polished face and traces of a keel

It has been seen above that at least one polished face and traces of a keel are characteristic of

grinders stained with ochre. Besides those so stained there were found ten examples of sandstone disk grinders with a more or less polished face and at least traces of a keel. These varied in maximum diameter from 50 to 90 mm.

K.H. 420 (Pl. 27, Fig. 9, and Pl. 28, Fig. 1) is a flattish circular disk of silcrete sandstone with maximum diameter 60 mm. and maximum thickness 25 mm. It has traces of a keel all round the circumference and two polished faces, one showing some artificial pitting.

K.H. 1311 (Pl. 27, Fig. 11) from conventional layer 70–80 cm. in square M 26 is a roughly circular disk of silcrete sandstone with maximum diameter 80 mm. and maximum thickness 34 mm. It has an irregular keel which is particularly marked at one end. One of the flat sides is rough and the other, which is smooth, has irregular pitting in one area to a maximum depth of about 2 mm. This grinder has been damaged by having flakes struck off the edge, presumably when used as a hammer.

K.H. 1319 (Pl. 27, Fig. 7) is an almost circular disk of silcrete sandstone of maximum diameter 96 mm. and maximum thickness 40 mm. It has a flat base and an originally convex upper surface in which has been made a definite pit of 7 mm. maximum depth. The circumference of the disk is rounded except where for about half its length it has been worn into a keel. One large flake and several small ones have been struck from the edge of the originally flat base, presumably when used as a hammer for breaking up lumps of ochre.

K.H. 424 is a roughly circular disk of ferri-silcrete sandstone that has one straight edge (? due to a fracture). The rest of the circumference is keeled, but has been damaged by flaking in two places, presumably due to use as a hammer. Maximum diameter 71 mm., maximum thickness 30 mm. Of the two flat faces one is smoother than the other.

K.H. 419 is a small fairly thick circular disk of coarse silcrete sandstone with maximum diameter 50 mm. and almost uniform thickness 25 mm. There is some irregular artificial roughening of each of the flat faces which have been rubbed smooth by grinding. There is a trace of a keel for about one-fifth of the circumference.

K.H. 442 is half a circular disk of silcrete sandstone with maximum diameter 60 mm., maximum thickness 23 mm. It has two flat faces, of which one is very smooth, and a rough keel round the circumference.

It may be presumed that the keel and the polished face in the above indicate that these tools were used for grinding ochre.

M 27 (60) (Pl. 27, Fig. 12) is an unusual almond-shaped grinder of sandstone with maximum length 90 mm., maximum width 70 mm., and maximum thickness 33 mm. Of the two convex faces, one is comparatively rough and the other smooth. There is a marked keel at the broad end and a flake or two have been struck from the narrow end. It came from conventional layer 100–20 cm.

K.H. 443 is a silcrete sandstone hammer-stone of roughly triangular cross-section with maximum length 60 mm. and maximum thickness 52 mm. It is included here because it has apparently also been used as an ochre grinder and shows traces of a keel on one of the three long edges.

K.H. 1307 (Pl. 27, Fig. 10, and Pl. 39, Fig. 3) is a small atypical circular disk of ferricrete sandstone with one smooth flat face. The other face is not so smooth and is slightly convex. The smooth face has a small artificial pit, and the other face has been artificially roughened. This tool has a definite keel along the edge. It may not have been an ochre grinder, but may have had some other purpose such as a boneworker's tool. Compare also the small disks described on p. 66.

K.H. 407 is included here as it seems to have traces of a keel and possibly to have been used as an ochre grinder as well as a pebble fabricator (see p. 49), in which class it could also be included. It is a flattish circular disk of blue gneiss; both of the flat faces show traces of high polish and have been subsequently roughened artificially, particularly in the centre. One of the faces is slightly

concave and the other definitely convex, the convexity probably due in the first place to the original shape of the natural pebble. The circumference has been thinned in places by flaking and seems to have been used all round for hammering as in the case of pebble fabricators.

K.H. 246 (Pl. 27, Fig. 13) is a roughly oval piece of slab ferricrete sandstone with maximum length 85 mm. and maximum thickness 36 mm. Both faces are worn smooth; the one illustrated has been roughened artificially and the other has irregular pitting in the centre. The edges are rougher than the flat faces, although in several places they have clearly been used for grinding at an angle to a lower grindstone and so at one end are tending to produce an incipient keel.

Pebble grinders shade into sandstone disk grinders, and circular examples of the latter shade into oval disks and the latter into almost rectangular grinders with rounded corners, and it seems impossible to isolate definite types, particularly as grinding or rubbing surfaces verge imperceptibly from flat on both sides through fairly convex to markedly so in one direction, and in the other direction through faint concavity to a definite hollow. Grinding surfaces similarly verge from slightly smooth through definitely smooth to markedly polished, the amount of polish depending apparently on the nature of the stone (the amount of silica in it) and the amount of use it has had. The roughening given to these smooth faces, in order presumably to make the grinder bite better and so be more efficient, also varies apparently according to individual taste and to the extent to which it is distributed irregularly more or less all over the face or concentrated in one area, which is then usually in the centre.

Pebble grinders have already been described, and such observations as it has been possible to make on the sandstone disk grinders will now be recorded. Those on which there are traces of red or yellow ochre, or which have keeled edges due to the intersection of two grinding faces (apparently a feature of ochre grinding), have already been mentioned.

Small disks of silcrete sandstone with at least one polished or highly smoothed face

Six small circular disks of silcrete sandstone with maximum diameter 55 to 60 mm. and thickness from 30 to 35 mm., with either one or both faces either highly smoothed or polished and the edge more or less rounded, were almost certainly used for ochre grinding.

K.H. 1306 (Pl. 27, Fig. 14) is rather smaller than the above, with maximum diameter 48 mm. and thickness 27 mm. It has both faces smooth and the edge has been damaged in one place by use as a hammer.

These small circular disks fade into an even commoner class of small oval disks of similar thickness which vary in length from 55 to 80 mm. and then shade into the larger disk grinders which will now be described. Both faces usually show evidence of use, and frequently one of them is polished with wear. They also are almost certainly ochre grinders as K.H. 1310 (see p. 52 and Pl. 27, Fig. 5).

Sandstone disk grinders with concave upper side and smooth underside

It has been seen that four of the grinders stained with ochre have concave upper surfaces opposite the flatter under surface (usually the one stained with ochre), viz. K.H. 215 (Pl. 27, Fig. 6) and K.H. 236, 436 (Pl. 26, Fig. 5), and 437.

K.H. 1437 is a circular disk grinder with an uneven upper surface giving it a sub-triangular section. A segment has been broken away from one side by two blows on the smooth slightly concave under surface. On the upper surface before this break occurred there was an elongated concavity, presumably due to the stone having been used as a lower grindstone as well as an upper one. The circular edge is roughened but shows traces of a keel. The maximum diameter is 90 mm. and the maximum thickness 43 mm.

A number of other grinders which show no traces of a keel or stains of pigment have the face opposite

the smooth face more or less concave, and were probably used as both upper and lower grindstones for reducing ochre to powder. They vary in maximum length from 175 to 95 mm., in thickness from 40 to 20 mm., and in shape from almost circular to the straight-sided oval of N 19 (6) (Pl. 29, Fig. 1). This latter is unique in size. (Does this type of grinder foreshadow the predynastic palette?) Then there are eighteen other examples and some fragments of which K.H. 1303, K.H. 213, and K.H. 1308 (Pl. 29, Figs. 2–4) show the range. There are also two other examples in which the smooth face has a small artificial pit. The roughly circular shape is as common as the straight-sided oval. Several of these grinders show broken or flaked-off edges, apparently due to their having been used as hammers, perhaps for breaking up lumps of ochre.

K.H. 1302 (Pl. 29, Fig. 5), though irregular on the top, being both convex as well as slightly concave, has no doubt been used as a lower grindstone as well as an upper, and should be included with the above.

Sandstone disk grinders with concave upper side and convex lower side

We now come to a group of grinders (twelve complete and nineteen fragments) which, besides being more or less concave on the upper side like the last mentioned, have the smooth underside more or less slightly convex. This convexity presumably came from use on a lower grindstone more or less hollowed by wear. In shape the grinders in this group are more or less circular, and in size similar to the average of the group with hollowed upper sides and flat undersides just discussed (the average maximum diameter being 95 mm.). One specimen, K.H. 439, which is not typical, is almost circular (maximum diameter 92 mm.) and has the smooth underside markedly convex while the upper side is both convex and concave as with K.H. 1302. This latter example has the lower side just slightly convex and the upper side as shown in the illustration. It is of silcrete sandstone with diameter 105 mm. and thickness varying from 35 to 18 mm. For K.H. 441, the segment of a circular grinder with a smooth convex underside stained with ochre, see p. 53. And the atypical fragment M 31 II (13) is so concave on the top and convex underneath as almost to suggest a small stone bowl (Pl. 29, Fig. 6).

K.H. 450 is a circular disk of coarse silcrete sandstone of maximum diameter 112 mm. and maximum thickness 38 mm. It is slightly concave on the upper surface, due to having been used as a lower as well as an upper grindstone.

K.H. 449 is an oval disk of yellow sandstone with all edges rounded except at one end. It is slightly convex on one side and slightly concave on the other through having been used presumably as both upper and lower grindstone. Its maximum diameter is 130 mm., minimum diameter 91 mm., and maximum thickness 32 mm.

K.H. 1317 (Pl. 29, Fig. 7) is a roughly circular disk (maximum diameter 120 mm., maximum thickness 52 mm.) and is slightly concave on the fairly smooth upper side, in the centre of which is a small pit about 15 mm. across by 2 mm. deep. The underside is so rough that the chief use of this tool would seem to have been as a lower grindstone, although the rounded edge indicates that that too was probably used for grinding.

Presumably the concavity on the upper side of all these grinders was due to their occasional use as lower grindstones.

Grinders used both sides, of which one side is flat and the other at least slightly convex

This is an unimportant group consisting of ten more or less complete examples and thirteen fragments, all of silcrete sandstone. The shape is roughly circular to oval, of an average maximum length of 105 mm. The convex side is nearly always the smoother, and the convexity seems to have been due either to use on a lower grindstone with a hollow in it, or else to being held at an angle to the lower

grindstone in order to exert more pressure and so to grind more finely. These implements were probably all used for ochre grinding.

K.H. 1313 (Pl. 31, Fig. 1) is one of them, from the ends of which flakes have been struck through having also been used as a hammer. The flatter surface has been slightly pitted.

K.H. 165 is another example with artificial pitting on either face and flakes struck from the edge by use as a hammer.

Grinders used on convex side only

A variety of the above consists of six complete examples and three fragments, all of silcrete or ferricrete sandstone, which appear to have been used on the convex face only. They vary from roughly circular to roughly oval outline, and are mostly of irregular section. The degree of convexity also varies.

Grinders with two flat surfaces

The grinders with one flat face and one slightly convex face shade imperceptibly into those which have both faces practically flat as in K 15 (2) 1 (Pl. 28, Fig. 2, and Pl. 31, Fig. 2). This is the largest example, the maximum length of complete examples varying from 134 mm. in this case to 90 mm. The shape is usually oval.

The pits shown in the surface of K 15 (2) 1 illustrated are probably natural, but the drawing shows how the edge at one end has been worn off by having been used at an angle to the lower grindstone. Such use presumably accounts for the rounded edge of most of this class and the incipient convexity of one or both surfaces. This type of grinder was presumably used on flat lower grindstones, for fragments of which see p. 70.

Six complete examples were found with a thickness of 25–30 mm. and two others were 43 and 45 mm. thick. Thirteen half-grinders were also found. In the above the flat faces are in the same plane. One oval example, K.H. 444, decreased in thickness from 33 mm. to 18 mm., while having a maximum length of 90 mm. It had clearly been used on one end when held at an angle (cf. K 15 (2) 1, Pl. 31, Fig. 2, above mentioned).

There were also three fragments of disks with one of the flat faces sloping and also five complete but irregular examples:

K.H. 179; coarse silcrete sandstone; maximum length 157 mm., maximum width 75 mm., thickness varying from 43 to 22 mm.; all edges rounded.

M 20 (6); coarse silcrete sandstone; maximum length 98 mm., thickness varying from 60 to 25 mm.; all edges rounded except one.

K.H. 461; ferricrete sandstone; maximum length 97 mm., maximum width 75 mm., thickness varying from 48 to 20 mm.; all edges rounded except one; faces slightly convex.

K.H. 462; ferri-silcrete sandstone; maximum length 101 mm., maximum width 69 mm., thickness varying from 35 to 10 mm.; all edges rounded.

K.H. 463; silcrete sandstone; roughly circular; maximum diameter 107 mm., thickness varying from 50 mm. to 10 mm.; upper face only slightly used.

Grinders with some angularity in one of their two major faces

In almost every case the face showing angularity is the smoother from more use.

These grinders shade imperceptibly into several of the groups which have already been described. In all cases the intersection between the two planes of the 'angular' face has been to some extent rounded with use.

K.H. 163 (Pl. 31, Fig. 3) is of silcrete sandstone and roughly oval in outline. Its maximum length is 126 mm. and maximum width 100 mm. It has an artificial hollow in the rough upper side

shown in the illustration, while the smooth lower face might almost be described as irregularly convex, and the grinder might have been included with those above described on p. 57 as concave on one side and convex on the other.

K.H. 169 (Pl. 30, Fig. 1, and Pl. 31, Fig. 4, where the smooth 'angular' underside is shown) is of silcrete sandstone. Maximum length 114 mm., maximum width 81 mm., maximum thickness 41 mm. The face opposite the smooth 'angular' one is rough but shows signs of use and is slightly concave, having possibly been used as a lower grindstone at times, so that it could almost have been included in the 'concave–convex' class. As shown in the illustration, its ends have been used as a hammer.

There are four other examples all of silcrete sandstone which also approach very closely to the 'concave–convex' class. They all have an apparently artificial concavity on the rough upper side. Three are roughly circular disks and one an elongated oval (K.H. 190). The former three have maximum diameters between 115 mm. (K.H. 170) and 100 mm. (two examples); and K.H. 190 has a maximum length of 103 mm., maximum width 70 mm., maximum thickness 33 mm., and shows a small area of artificial pitting on the smooth face.

Two other examples (K.H. 180 and 181, see Pl. 31, Figs. 5 and 6) have smooth more or less 'angular' under surfaces and flattish, rough, and to some extent pitted upper surfaces. Both are of silcrete sandstone and circular in outline.

K.H. 180 has a maximum diameter of 112 mm. and maximum thickness of 36 mm. and has had flakes knocked off in places through being used as a hammer.

K.H. 181 has a maximum diameter of 60 mm. and maximum thickness of 25 mm. One side of the angular face is almost polished, and this tool can confidently be classed with those described on pp. 52–4 as ochre grinders. O 19 (4)—see p. 54—had two polished irregularly convex faces verging on the angular, is approximately the same size, and was still stained by yellow ochre. See also p. 54 for K.H. 408, a roughly oval pebble of silcrete sandstone with one polished angular face stained with red ochre.

Another rough example of silcrete sandstone with maximum length 63 mm., maximum width 52 mm., maximum thickness 30 mm., has two smooth faces, one convex and the other verging on the angular, and is also no doubt an ochre grinder.

K.H. 183 (see Pl. 31, Fig. 7) is a roughly circular disk of silcrete sandstone; maximum diameter 77 mm., maximum thickness 35 mm. Both faces have been used for grinding, but the angular face, on one side of which is a small area of artificial pitting, is smoother than the approximately flat one, which also is artificially pitted for about one-third of its area. Five other examples (including K.H. 178, 186, 189) are of approximately the same shape and size, two being rather thinner.

Similar to the last two but of more elongated shape is K.H. 171 (Pl. 31, Fig. 8), which is of silcrete sandstone. Maximum length 107 mm., maximum width 80 mm., maximum thickness 25 mm. It too is smoother on the angular face than on the approximately flat one. One other example and five fragments are similar to K.H. 171; and one, K.H. 167, has a marked pit in the flatter side. Three other fragments indicate thicker examples with a maximum thickness of about 40 mm.

Two other examples (K.H. 185 and 194) are of irregular outline and smaller, with an approximate maximum length of 60 mm. and maximum thickness of 20 mm.

We have already seen above (p. 58) that a flat disk grinder K 15 (2) 1 was worn on the edge at one end through having been held at an angle to the lower grindstone. Five other examples with one of the faces angular apparently owe that angularity to becoming worn in this way by being held at an angle to the lower grindstone. Three are straight-sided oval disks of about 30 mm. maximum thickness, which vary in maximum diameter from 95 to 100 mm. Of these K.H. 447 has been worn along one of the long sides, K.H. 448 somewhat obliquely on the edge of one of the short sides, and K.H. 245

has been worn at one corner. The first two are smooth on both sides, while K.H. 245 is rough on the upper side, in the centre of which is an area about 20 mm. in diameter pitted to a depth of about 3 mm.

Two other examples are roughly circular in outline. K.H. 166 has a maximum diameter of 102 mm. and has been worn in one place through having been held at an angle to the lower grindstone. K.H. 446 has a maximum diameter of 80 mm. and has been worn in two places through having been used in the same way.

The only example which is rougher on the angular face than on the other face, which in this case is convex with artificial pitting in the centre, is K.H. 245. It is of yellow sandstone and has an oval outline with a maximum diameter of 115 mm. and a minimum diameter of 90 mm. It has probably been used on one half of the angular face as a lower grindstone and on the other as an upper; and all its edges are rounded.

Grinders with two slightly convex faces

This group consists of three oval disks of silcrete sandstone varying in maximum diameter from 90 to 102 mm. and all about 35 mm. in maximum thickness, two others of similar size from the edges of which pieces have been broken anciently, and eight fragments each approximately half a disk. They are placed here because, although it was thought at first that they would shade into the rubbers apparently used for bone and woodwork which are described later on p. 64, their edges are in most cases fairly straight and there are no intermediate forms between them and these rubbers, from which they are presumably a different type of tool.

This present group is presumably a development from the grinders with two flat faces or one flat and one slightly convex face, and is the natural result of increased wear.

PITTING OF SURFACE OF GRINDERS

The purposive artificial roughening of the flat surface of grinders worn smooth by use until they became too smooth to grind efficiently and had to be roughened has been mentioned from time to time in the foregoing pages. This roughening may be sporadic or diffused more or less all over the flat grinding surface, or it may be more or less concentrated in an area frequently 10 to 15 mm. in diameter, and when it is more than 1 mm. deep in such a position it begins to assume the appearance of a pit, and to suggest that it may have had some purpose other than mere freshening of the grinding surface. This is particularly the case in an example such as K.H. 1318 (Pl. 30, Fig. 3, and Pl. 32, Fig. 7), which has an elongated pit in a generally roughened area in the centre of a very slightly concave rougher upper surface opposite a smooth approximately flat lower surface, the latter being obviously the usual grinding surface when the specimen was used as an upper grindstone. K.H. 1318 is of silcrete sandstone as usual, maximum length 133 mm., maximum width 105 mm., maximum thickness 40 mm.

Such pitting may of course be an incipient stage by which such a tool became at the same time a small lower grindstone with a concave upper surface such as has already been described on p. 56. K.H. 1303 (Pl. 29, Fig. 2), K.H. 1308 (Pl. 29, Fig. 4), K.H. 163 (Pl. 31, Fig. 3), K.H. 215 (Pl. 27, Fig. 6), K.H. 1319 (Pl. 27, Fig. 7), and K.H. 213 (Pl. 28, Fig. 3) already described show various stages by which general roughening of the upper surface leads to a marked concavity in the upper surface. And K.H. 1317 (Pl. 29, Fig. 7) shows what appears to be a small lower grindstone at an early stage with a small pit in the centre.

Apart from those already mentioned in the foregoing pages, there are fifteen other examples all approximately oval in outline which have a smooth under surface and some form of pitting or incipient concavity of more or less rough outline near the middle of the upper surface. These examples vary in maximum length from 72 to 135 mm., and in maximum thickness from 15 to 38 mm.

K.H. 290 (Pl. 32, Fig. 5) is an oval grinder of silcrete sandstone, with maximum length 95 mm., maximum width 65 mm., and maximum thickness 30 mm. It has more or less perpendicular sides and a smooth irregularly convex underside that has no doubt at times been used at an angle to the lower grindstone. In the rougher upper surface there is a regular circular pit about 3 mm. deep in the centre and about 20 mm. in diameter. This pit is not situated in the centre of the face in which it occurs, and it suggests some purpose other than mere roughening. And it should be noted that, as in K.H. 1319 (see p. 55), a definite pit occurs in the upper surface of some grinders that from their having a keeled edge are thought to have been certainly ochre grinders. It may therefore be that the pit had some purpose in connexion with the grinding or use of ochre (see p. 118).

K.H. 1305 (Pl. 30, Fig. 2, and Pl. 32, Fig. 1) is a circular disk of silcrete sandstone, of maximum diameter 70 mm., thickness 25 mm. Both flat faces have been used for grinding, and in the centre of the one that is slightly smoother than the other there is a small circular pit of about 15 mm. diameter and 1 to 2 mm. in depth.

Six examples other than those already mentioned occur of medium-sized circular to oval sandstone grinders in which the pitting is on the smooth side, and seems to be a form of roughening.

Grinders with pitting on either face

We must now consider a group of grinders with pitting on one face and pitting or roughening on the other. There are twenty-nine examples, in addition to those which have already been described. They are all of sandstone, and vary from circular to oval in outline, and from 63 to 125 mm. in maximum length. They are all disks of more or less uniform thickness, which varies from 15 to 37 mm.

K.H. 1316 is a roughly circular disk of ferri-silcrete sandstone, maximum diameter 95 mm., maximum thickness 35 mm. It has two flat faces, the centre of each of which has been roughened in a more or less diffuse way (see Pl. 32, Fig. 4), although the roughening is deepest at the centre. (This grinder, like many others, has had flakes struck from the edge, presumably when used as a hammer for breaking up lumps of ochre.)

K.H. 1315 (Pl. 32, Fig. 2) is an oval disk of ferri-silcrete sandstone with perpendicular edges and two flat faces each of which has been used for grinding, and each of which has shallow pitting in the centre. Maximum length 78 mm., maximum width 52 mm., maximum thickness 20 mm.

K.H. 1314 (Pl. 32, Fig. 6) is an irregular oval disk of ferri-silcrete sandstone, maximum length 110 mm., maximum width 85 mm., maximum thickness 38 mm. All the edges, which were once perpendicular and have been fractured in places by hammering, have been somewhat rounded with use, and in one place a kind of keel has developed, where the tool has been used at an angle to the lower grindstone. In the centre of each slightly convex face is a small pit. On the side illustrated the pit is about 3 mm. deep in the centre and of irregular outline, and on the other side it is approximately circular, about 15 mm. in diameter and 2 mm. deep.

K.H. 216 (Pl. 30, Fig. 4, and Pl. 32, Fig. 3) is an irregular oval disk of silcrete sandstone, maximum length 68 mm., maximum width 55 mm., maximum thickness 30 mm., with rounded edges which have been rubbed flat at one corner by being used at an angle to the lower grindstone. In either flat face it has a proportionately large circular depression 2 to 3 mm. deep, each approximately opposite to the other. These depressions are regular in shape, and the surface of them is rougher than that of the rest of the flat surface.

There are also to be noted five fragments of sandstone grinders with a small pit in one flat face, and four examples with small rough pits in each of the two flat faces, in all of which it appears that these pits were probably made after the grinder was broken, for they would not have been in the centre of

the grinder in its original shape. This may, however, only mean that the fragment continued in use as a grinder after it had been broken.

Grinders with a regular circular depression in each face

We now come to a group of over thirty semicircular fragments of disk grinders which have had a regular circular depression made in the centre of each flat face of the original disk. No complete examples were found, and most of the examples were broken more or less diametrically across the depressions. See Pl. 33, Fig. 1, and Pl. 36, Fig. 1, for a typical example M 28 (13) found in conventional layer 120–40 cm. This example is 92 mm. in diameter and 20 mm. thick, and is made of rather finer sandstone, and so is slightly more regular than the majority, which are mostly of coarse silcrete sandstone. It has had a flake broken from one edge of the fracture since the original fracture, which appears to be ancient.

It at first appeared that these are stone rings such as K.H. 126 (Pl. 35, Fig. 1, and Pl. 36, Fig. 6) or K.H. 1300 (Pl. 35, Fig. 2, and Pl. 36, Fig. 7) which broke in the making, but on consideration it appears unlikely that this is the case.

Examples found vary from 67 to 112 mm. in diameter, and in thickness from 18 to 37 mm. They have all been made from grinders such as those described in the foregoing pages, and they appear to have been made from more or less regular disks of circular or oval outline. The circular outline seems to predominate, but it is hard to be certain from broken examples only.

The depressions are usually more or less regular and opposite each other as in M 20 (5) (Pl. 33, Fig. 2), but ten examples occur in which the depressions are either not the same size or not exactly opposite each other, as in K.H. 91 (Pl. 36, Fig. 3).

Two fragments of slab sandstone show evidence of partial 'hour-glass' perforation, and in each case have broken across the hole. K.H. 112 was probably about 70 mm. square before it was broken. It is 48 mm. thick, and funnel-shaped depressions had reached within 18 mm. of each other.

K.H. 464 is an edge fragment (maximum length 95 mm.) of a ferri-silcrete lower grindstone which is concave on either side, in this respect resembling K.H. 209 (Pl. 36, Fig. 21, and p. 72), although it differs in that there is no definite rim to the depressions as in K.H. 209. In the centre it had worn until it was only 20 mm. thick, and here two funnel-shaped depressions about 20 mm. in diameter had almost met when the fracture occurred.

Three roughly rectangular fragments (Pl. 33, Figs. 4–5) all approximately 70 mm. square and 40 mm. thick have shallow depressions of similar size on opposite sides, although the depressions are not of the regular funnel shape as in M 28 (13) (Pl. 36, Fig. 1) but shallower as in K.H. 237 (Pl. 33, Fig. 6, and Pl. 36, Fig. 4), which is a fragment of an approximately oval grinder, or possibly of the outer edge of a flat lower grindstone, which has had this shallow depression made on one side only.

One other grinder which has a regular shallow depression on one side only and not in the centre of the grinder is K.H. 290 (Pl. 32, Fig. 5), described above on p. 61, and with it should be compared the rubber K.H. 157 (Pl. 37, Fig. 8, and Pl. 38, Fig. 5) which is described on p. 65 below.

One fragment of a grinder has a similar shallow depression on one side only, while three other fragments of grinders all varying in thickness from 35 to 40 mm. have such shallow depressions opposite each other on either side. In some of the above it appears probable from the position of the depressions that they were made after the grinder was broken. That this was so is clear in the case of the unique fragment K.H. 248 (Pl. 33, Fig. 3, and Pl. 36, Fig. 5), which is of silcrete sandstone 95 mm. in diameter and 27 mm. thick, having regular circular depressions about 3 mm. deep opposite each other on either face. The surface of one of these depressions is smooth, and that of the

other somewhat rough. It now becomes certain that these depressions must have had a purpose other than that of perforating the grinder, and on p. 118 it is suggested that it was the grinding or use of ochre.

STONE RINGS

The natural result of prolonged use would be that the depressions just described above eventually met in the middle, resulting in the perforation of the stone. And apart from examples showing complete perforation we found fourteen examples which show all stages in the growth of the perforation from a small irregular hole to one of approximately 20 mm. diameter (see Pl. 34).

It is remarkable that no complete rings were found (with the perforation either unfinished or finished), but only fragments, a number of which are semicircular and others segments. This fact suggests that the fracture may possibly have been intentional and that these stone ring fragments were never used as complete rings, but had some other purpose in their present form such as hollow scrapers (or rather ring rubbers) for shaping shafts of bone or wood. I think, however, that it is more probable that the explanation lies in the disturbed and eroded nature of the site. A complete stone ring found on the surface or turned up by grave-diggers during the siege of Khartoum must have attracted attention whenever it was found, and would inevitably either have been removed as a curio, or more likely broken out of idle mischief. It is, however, to be remarked that though all fragments found were carefully kept, we found no two pieces that fitted together.

Pl. 35, Figs. 1–4, and Pl. 36, Figs. 6–9, show four typical examples.

The diameter of the perforation or hole appears in the majority of cases (twenty-three examples) to have been about 30 mm., just about the diameter of a wooden club handle, as with the stone-headed clubs still used in the Nuba Mountains. In seven examples the hole seems to have been about 40 mm. in diameter, as in K.H. 126, and might therefore have been worn as a bracelet on the wrist. It is doubtful, however, whether they were so worn, as in most of these examples, e.g. in K.H. 126, the hour-glass perforation has resulted in a more or less sharp keel on the inside of the hole, which would have been uncomfortable and have chafed the skin.

K.H. 126 (Pl. 35, Fig. 1, and Pl. 36, Fig. 6) is of silcrete sandstone and appears to have been approximately circular, in which case its maximum diameter must have been about 110 mm. Its maximum thickness is 31 mm., and the two approximately flat faces show that it was made from a grinder that had been used on both sides.

K.H. 1300, K.H. 1301, and M 30 (6) are three examples of those which have the diameter of the bore at the waist of the hour-glass perforation about 30 mm.

K.H. 1300 (Pl. 35, Fig. 2, and Pl. 36, Fig. 7) is of silcrete sandstone and appears to have been approximately circular, with diameter about 103 mm., maximum thickness 25 mm., and diameter of bore 30 mm. It was made from a grinder with one flat and one somewhat convex face.

K.H. 1301 (Pl. 35, Fig. 3, and Pl. 36, Fig. 8) is of silcrete sandstone, and seems to have been approximately circular, with diameter 90 mm., maximum thickness 29 mm., and diameter of the bore 29 mm. It was made out of a grinder with a smooth flat side and a slightly rougher convex side. The ridge where the two perforations met has been largely worn away.

M 30 (6) (Pl. 35, Fig. 4, and Pl. 36, Fig. 9) is of silcrete sandstone, and is of rather irregular shape, appearing to have been somewhat oval in original outline. Its maximum diameter may have been about 102 mm., maximum thickness 33 mm., and the diameter of the bore at the waist of the hour-glass perforation 32 mm. It was made from a grinder which had one smooth flat face and the other face rough and uneven.

One fragment (K 26 (21)) appears to have had a more or less finished hole only about 15 mm. in diameter.

A few larger stone-ring fragments have been found associated with Wavy Line sherds on the surface of other sites, e.g. one of silcrete sandstone, maximum diameter 135 mm., maximum thickness 60 mm., and diameter of bore 45 mm., from the site north of Omdurman (Khartoum Antiquities Collection Catalogue No. 4049), and an even larger very rough one of silcrete sandstone, approximate maximum diameter 250 mm., maximum thickness 70 mm., and diameter of bore 90 mm., from another site where Wavy Line sherds occur at Matruka, latitude 16° 18′ N., longitude 33° 19′ E. (Khartoum Antiquities Collection Catalogue No. 5153).

The existence of such large ring fragments in association with Wavy Line sherds makes it impossible to be certain how these sandstone rings were used, but the best guess seems to be that the majority of those found in our excavation were used as weights for sticks, thus making stone-headed clubs comparable to those with spherical stone heads still used in the Nuba Mountains and possibly connected with the disk mace-heads of the Egyptian Predynastic. The latter are believed to occur with the Gouge Culture, which seems to have followed the Wavy Line Culture in the Sudan (see p. 93).[1]

RUBBERS

Sandstone rubbers, perhaps used for working wood and bone

We now come to a class of sandstone tool which is not linked to the series of sandstone grinders (believed probably all to have been used for grinding ochre and described above on pp. 52–60). Owing to the fact that there are no intermediate forms between the disks known to have been ochre grinders and the tools now to be described, it is with the greater confidence that they are distinguished as a different type of tool, possibly a rubber for wood or bone, the place of which has been taken in modern carpentry by sandpaper. It must, however, be admitted that these tools too could also have been used for grinding ochre, although it is perhaps significant that no ochre-staining has been noticed on them.

Most of these tools have a roughly oval outline, and almost all have at least one rounded end, while either one or both of the long edges is to some extent keeled, and it is suggested that the keeled edge and the rounded end were the most important features. In a number of cases either both the flatter surfaces are smooth or one is smoother than the other, suggesting that these surfaces were also used for grinding or rubbing, where the tool is too thin still to bear the traces of use as the grinder from which it may have been made.

A few examples occur of flattish oval rubbers of the general size and outline of K.H. 1321 (Pl. 37, Fig. 1, and Pl. 38, Fig. 1), which differ from it in having no incipient keel on either long side. Two examples vary from 88 to 100 mm. in maximum length, 48 to 58 mm. in maximum width, and 20 to 28 mm. in maximum thickness.

Fairly thick rubbers of similar size and outline occur with either one long side rounded and the other worn sharp, or with both long sides becoming worn to an edge. In the former the length varies from 85 to 120 mm., and in the latter from 70 to 113 mm.

Those with one long edge only used, or with one edge used more than the other, tend to become hollow along that edge, probably from use on rounded shafts of wood and bone, and are therefore described as hollow rubbers.

Hollow rubbers

A number of examples from a series of about twenty will now be described. No two examples are exactly similar.

[1] See also Dalloni, 1936, pp. 195–7 and figs. 66–7.

K.H. 198 (Pl. 37, Fig. 2) is of silcrete sandstone, maximum length 115 mm., maximum width 63 mm., and maximum thickness 30 mm. The side illustrated is slightly flatter than the other. Both long sides have an incipient keel at the edge, particularly that illustrated. One end is rounded and the other rough, but the edge at the rounded end is not becoming sharp as on the long sides.

K.H. 1321 (Pl. 37, Fig. 1, and Pl. 38, Fig. 1) is of silcrete sandstone, maximum length 96 mm., maximum width 58 mm., and maximum thickness 31 mm. The side which is illustrated is smoother than the other, and in the centre of one side there is an incipient hollow, which was no doubt the area of greatest use. The edge of the long side opposite that illustrated in the second view (Pl. 37, Fig. 1) is not quite so sharp.

Q 20 (3) (Pl. 37, Fig. 3, and Pl. 38, Fig. 2) is of silcrete sandstone, maximum length 115 mm., maximum width 62 mm., and maximum thickness 40 mm. It has one side convex (that illustrated), and the other apparently originally flat but sloping towards either long edge. It may have been made from the fragment of an approximately oval grinder as has clearly been done in the case of K.H. 156, which resembles Q 20 (3) in shape. The long edge of Q 20 (3) illustrated has been worn to a definite keel, the greatest wear being towards the centre of the flat side of this edge.

K 25 (10) (Pl. 37, Fig. 6, and Pl. 38, Fig. 3) is of silcrete sandstone, maximum length 112 mm., maximum width 75 mm., and maximum thickness 30 mm. It certainly belongs to this class of hollow rubbers, and it belongs also to another possible class of which K.H. 334 (Pl. 37, Fig. 9) and Q 19 (6) (Pl. 37, Fig. 10) are typical, and which is described below (see p. 66). This class all have a rough base and a carefully shaped tip which is rounded as in the present case, or as with K.H. 334, and develops in rare examples such as Q 19 (6) into a point.

Both edges of K 25 (10) are somewhat keeled, and one side is more convex than the other. In the centre of one edge and on the more convex side there is a concavity due no doubt to the tool having been used blunt end uppermost for shaping shafts of wood or bone.

Half a dozen examples varying in length from 70 to 100 mm. have a similar concavity more or less developed towards the centre of one side of the more pronouncedly keeled edge.

K.H. 159 (Pl. 37, Fig. 7, and Pl. 38, Fig. 4) is an unusual example of silcrete sandstone, maximum length 140 mm., maximum width 55 mm., and maximum thickness 30 mm. It has a marked concavity (deepest in the centre) on one side of the single keeled edge which is itself curved. The other long edge is thick and roughly rounded, showing no traces of use as a tool.

K.H. 157 (Pl. 37, Fig. 8, and Pl. 38, Fig. 5) is another unusual example of silcrete sandstone, maximum length 110 mm., maximum width 57 mm., and maximum thickness 40 mm. It has been broken anciently at one end. All edges are roughly rounded except one, which alone shows evidence of use, having been used apparently as a hollow rubber for shaping shafts on either side of the keel. This example is also unusual in having an area of circular shallow pitting about 30 mm. in diameter and 2 mm. deep in the centre of one side which is smooth and may have been used for rubbing or grinding. Indeed, it seems as if this unusual tool may have had more than one purpose.

M 15 (5) 1 (Pl. 37, Fig. 4) is another unusual example of silcrete sandstone, of roughly crescentic outline—maximum length 116 mm., maximum width 50 mm., and maximum thickness 15 mm. It is unusually thin, probably from much use which has hollowed one of the edges. It too was probably used for shaping shafts.

N 23 (1) (Pl. 37, Fig. 5) is a unique example which shows no noticeable hollowing on either side of its one thin edge. It is comparatively rough on one face and smooth on the other, which alone has certainly been used. It could well have been used for shaping wood or bone. It also is of silcrete sandstone, maximum length 83 mm., maximum width 42 mm., maximum thickness 20 mm.

Two fragments of thin rubbers such as the last two were also found.

K.H. 460 (Pl. 38, Fig. 6), a tool of very unusual shape (maximum length 145 mm.), was made from a slab of silcrete sandstone that had been given a lenticular cross-section by being used as a grinder. One edge has been worn into a keel, one side of which is slightly concave, presumably due to being used for shaping shafts, and this keel goes partly round a horn-like prominence at one corner of the slab which has been rounded with use. This tool is probably only an unusual form of the hollow rubber.

Blade rubbers

We now come to a large class of blade-like rubbers of which K.H. 334 (Pl. 37, Fig. 9, and Pl. 38, Fig. 7) is typical. They have a rough flat base broken often anciently as indicated by kankar on the fracture. The surfaces are smooth and more or less convex, with the long edges more or less sharp or keeled. The tip is usually rounded, but it seems rather the curved edge approaching the tip rather than the tip itself which was important to the user, for the tip itself is often slightly thicker than the edges, which seem to have been the most important part of the tool (see the description of K 25 (10) on p. 65).

Over forty examples were found, all of silcrete or ferri-silcrete sandstone, and they varied in maximum length from 53 to 115 mm., in maximum width from 50 to 85 mm., and in maximum thickness from 20 to 38 mm. Extreme measurements are less common than those approaching the mean. A number seem to have been originally longer and to have been broken in antiquity, and there are about fourteen examples of the lower portion, several of which came from low conventional layers, e.g. 200–20 cm. in square M 30.

K.H. 334 (Pl. 37, Fig. 9, and Pl. 38, Fig. 7), the characteristic tool of this type, is of silcrete sandstone, maximum length 95 mm., maximum width 64 mm., and maximum thickness 23 mm. It has a rounded tip, and one long edge rather sharper than the other long edge or the tip itself.

Q 19 (6) (Pl. 37, Fig. 10, and Pl. 38, Fig. 8) is an extreme example in which the tip has a definite point. It is of silcrete sandstone, maximum length 112 mm., maximum width 88 mm., maximum thickness 31 mm.

Roughly cylindrical rubbers

Five rubbers with an oval cross-section and varying in length from 45 to 75 mm. lead to a small group of six more or less cylindrical sandstone rubbers (Pl. 37, Figs. 11–12, and Pl. 39, Fig. 1), of which K.H. 332 (Pl. 37, Fig. 11, and Pl. 39, Fig. 1) is taken as characteristic. It is 80 mm. in maximum length, 35 mm. in maximum width, and, like all this group, is not a true cylinder, being flatter on one or two faces.

K.H. 1320 (Pl. 37, Fig. 12, and Pl. 39, Fig. 1) is the flattest of this group, although it has a more or less cylindrical point. Its maximum length is 70 mm., maximum width 50 mm., and thickness 25 mm. It is probably an early stage before being reduced to the more cylindrical form of K.H. 332 by wear.

Three sandstone rubbers with a triangular section were found, of which K.H. 162 is shown on Pl. 37, Fig. 13. It has a maximum length of 75 mm. and maximum diameter of 42 mm.

Small disk rubbers or grinders that may have been tools other than ochre grinders

On p. 55 we described K.H. 1307 (Pl. 27, Fig. 10, and Pl. 39, Fig. 3), a small circular disk of ferricrete sandstone that was included with the ochre grinders because it had a keel. We must now describe several other small flat circular disks of sandstone that may have had some use other than for grinding ochre, such as possibly for shaping bone or wood.

Three roughly circular disks of ferri-silcrete sandstone have rounded edges. They vary in diameter

from 80 to 65 mm. and in maximum thickness from 20 to 15 mm. One which came from conventional layer 180–200 cm. in square M 30 had several flakes struck from its edge by hammering.

This is a feature of two roughly circular disks of mudstone, which had maximum diameters of 80 and 60 mm., and maximum thickness of 15 and 10 mm.

Then comes a group of six circular disks all of ferricrete sandstone except one, which is of silcrete sandstone, and all of which have rounded edges.

M 26 (39) (Pl. 36, Fig. 14, and Pl. 39, Fig. 3) is a circular disk of ferricrete sandstone, maximum diameter 46 mm., and average thickness 15 mm. It is rather rough on each flat surface, and the rounded edge was probably the most important part.

The other disks are all more or less regularly circular and they are all approximately 40 mm. in diameter and 10 mm. in thickness. From the edges of two of them a few flakes have been struck, suggesting that they were sometimes used for hammering.

Next comes a group of small circular disks with slightly convex upper and lower surfaces, and a more or less perpendicular edge. Most of them are of ferricrete sandstone, but two are of silcrete sandstone and one is of quartz.

K.H. 49 (Pl. 36, Fig. 15, and Pl. 39, Fig. 3) is of ferricrete sandstone, 50 mm. diameter and 17 mm. in maximum thickness. The surface illustrated is smooth and slightly convex, the other surface shows traces of polishing and several scars where small flakes have been struck from the edge.

L 19 (1) (Pl. 36, Fig. 10, and Pl. 39, Fig. 4) is a circular disk of quartz with regular well-balanced convex surfaces. These surfaces are smooth, while the perpendicular edge (10 mm. deep) is slightly rough. The maximum diameter of this disk is 34 mm., and its maximum thickness 20 mm.

L 18 (1) (Pl. 36, Fig. 11, and Pl. 39, Fig. 4) is a regular thickish disk of silcrete sandstone, with fairly smooth convex faces, and a somewhat rougher perpendicular edge of 14 mm. in depth. Its maximum diameter is 30 mm. and its maximum thickness is 23 mm.

M 23 (4) (Pl. 39, Fig. 4) is very similar in shape and size to L 18 (1) but it is rougher, being made of coarser sandstone.

L 25 (11) (Pl. 39, Fig. 4) is of ferricrete sandstone with one face more convex than the other. Both faces are smooth, and the perpendicular edge is somewhat rough (9 mm. deep) and has had several flakes struck from the edge of one face. Its maximum diameter is 30 mm. and maximum thickness 15 mm.

M 23 (3) (Pl. 39, Fig. 4) is a regular circular disk of ferricrete sandstone, maximum diameter 28 mm., maximum thickness 15 mm. The faces are only very slightly convex, and flakes have been struck from the edge of one face by hammering. The depth of the perpendicular edge, which is similar in roughness to that in the foregoing examples, is 11 mm.

K.H. 48 (Pl. 39, Fig. 4) is a regular circular disk of ferricrete sandstone, maximum diameter 30 mm., maximum depth 12 mm. One face is flat and the other slightly convex, and small flakes have been struck from the edge of the flat face by hammering. The depth of the slightly rough perpendicular edge is 9 mm.

L 22 (2) (Pl. 36, Fig. 12, and Pl. 39, Fig. 4) is a circular disk of ferricrete sandstone with two flat and somewhat polished faces, and a more or less perpendicular edge which is of similar roughness to that in the foregoing examples. Its diameter is 25 mm. and thickness 12 mm.

L 24 (8) (Pl. 36, Fig. 13, and Pl. 39, Fig. 4) was probably originally a circular disk of silcrete sandstone similar in size to L 22 (2), but it has been worn into an uneven cylinder by irregular rubbing of the edge.

We now come to a small group of small roughly oval rubbers of coarse gritty sandstone that have

the appearance of short slightly flattened sausages (Pl. 39, Figs. 5–6). Their nature and shape pronounce them probably to have been used for shaping wood and bone like sandpaper. The flat smooth face of some of them, as in K.H. 1309 (Pl. 36, Fig. 16, and Pl. 39, Fig. 5), proclaims their possible origin from small ochre grinders, such as those described on p. 56.

K.H. 1309 is an oval disk of gritty silcrete sandstone, maximum diameter 43 mm., minimum diameter 38 mm., maximum thickness 25 mm. Its edges are rough and roughly rounded. The face illustrated is smoother than the other, and may have been used at some time for grinding ochre.

The largest is 60 mm. long by 48 mm. wide and 25 mm. thick. It has rough rounded edges and rounded ends; one face is slightly more convex than the other, and the flatter face is smoother than the more convex one.

Another example is 55 mm. long, by 40 mm. wide, and 25 mm. in maximum thickness. It has rough rounded edges and rounded ends: one face is rough and roughly convex, and the other is smoother and flat with a shallow artificial concavity, indicating that it may have been used for grinding ochre.

Another example is 45 mm. long, 35 mm. in maximum width, and 22 mm. thick. It has one face approximately flat and is rounded everywhere else.

Three other examples vary in length from 44 mm. to 40 mm. and are progressively more rounded. Indeed, any of the last three, if they had had a groove round their waist, would have made one of the ? fishing-line sinkers which are now to be described.

? FISHING-LINE SINKERS

In all thirty-one complete examples and four fragments were found. With two exceptions to be described they are all short sausage-shaped objects of sandstone with rounded ends, frequently as in the foregoing examples somewhat flattened because made originally from flat pieces of sandstone or perhaps from sandstone grinders, and their essential characteristic is a groove round the waist, as shown in the illustrations (Pl. 36, Figs. 17–20, and Pl. 40, Figs. 1–4). This groove varies in depth from 1 to 3 mm.

In length examples vary from 50 mm. to 28 mm. The most typical examples figured which are about average in size are K 26 (9) (Pl. 36, Fig. 17, and Pl. 40, Fig. 1) and M 26 (5) (Pl. 36, Fig. 18, and Pl. 40, Fig. 1).

K 26 (9) (maximum length 43 mm., maximum width 29 mm., maximum thickness 24 mm.) is of sandstone and has an oval (slightly flattened) section. The groove is 5 mm. wide and 2 to 3 mm. deep.

M 26 (5) (maximum length 45 mm., maximum width 31 mm., maximum thickness 25 mm.) is of ferricrete sandstone and also has an oval (slightly flattened) section. The groove is 6 mm. wide and 3 mm. deep.

J 14 (8) (Pl. 36, Fig. 20, and Pl. 40, Fig. 3) is an unusually irregular example of ferricrete sandstone, which has a very pronounced groove.

X 28 (Pl. 36, Fig. 19, and Pl. 40, Fig. 1) is one of the smallest examples found. It is of coarse ferrisilcrete sandstone, and has an approximately circular section. Its maximum length is 31 mm. and its maximum diameter is 18 mm.

The material in all examples is sandstone except for two which are made from kankar concretions.

In most of the examples, as in those illustrated, the groove is definite and pronounced, but in some half-dozen examples it is only slight and shallow, and in the case of one example L 18 (5) (maximum length 48 mm.) it is so slight and incomplete that this one might be classed with the foregoing small sausage-shaped rubbers except that in addition to having the suspicion of a groove for part of its circumference, it is not of such gritty sandstone as those other rubbers.

Two atypical 'line-sinkers' are the following:

I 14 (2) is of irregular shape with roughly rounded edges and a roughly triangular section, no doubt having been made originally from a piece of sandstone with a triangular section, as has at least one of the more regular 'line-sinkers'. It is of heavy ferricrete sandstone and maximum length 35 mm.

K.H. 454 (Pl. 40, Fig. 1) is a small flattened oval disk of sandstone with rounded edges and a shallow groove round the waist. Maximum diameter 25 mm., maximum thickness 9 mm. It is reminiscent of several objects of burnt clay (see p. 80), which it is suggested may also have been line-sinkers.

It is not certain that the objects now described were used as line-sinkers, for no obvious fish-hooks were used, but they are similar in form to line-sinkers still used in Ireland to-day (Estyn Evans, 1942, fig. 95 and p. 146) and possibly in the Sudan, although those noticed, while of sandstone and of approximately the same size, are not rounded; see Pl. 40, Fig. 2, for a photograph of a modern example from Delgo between the Second and Third Cataracts. Similar grooved stones but rather larger (3 in. long) were found by Miss G. Caton Thompson in the Fayum (*The Desert Fayum*, pp. 39–40 and pl. 39, figs. 7–9). Since the people of the early settlement at Khartoum could make twine and ate much fish, and may have used *Ampullaria wernei* for bait, it is reasonable to suppose that in default of hooks they may have used natural bone fragments as gorges. If not used as line-sinkers, these stones may have been used as weights for fishing-nets. The weights of the seine nets depicted in the Old Kingdom mastabas of Ancient Egypt (*c.* 2400 B.C.) are of similar shape but larger (see Petrie, 1892, pl. XXVIII. 7, and Montet, 1925, pl. IV). Another possible explanation is that they are small rubbers used by bone-workers, who, having no pockets, wore them suspended round their necks to prevent loss.

OTHER GROOVED STONES

It is not certain that the following date from the early settlement, but from traces of kankar adhering to some of them it is thought that they do.

Two are flat roughly oval disks of sandstone, with rounded edges such as have already been described (p. 58).

K.H. 455 (Pl. 41, Fig. 1) has maximum length 95 mm., maximum width 75 mm., and maximum thickness 30 mm. It has an area of shallow pitting in the centre of one face, and there are a number of rather indeterminate shallow grooves running longways down the middle of the other face.

K.H. 456 (Pl. 41, Fig. 2) is a similar object, maximum length 95 mm., maximum width 70 mm., and maximum thickness 20 mm. It also has an area of artificial pitting in the middle of one face, and a definite groove running longways down the middle of the other face.

N 16 (8) (Pl. 40, Fig. 5) is also of rough flat oval shape. It is a water-worn pebble of basic hornblendic gneiss with a definite groove longways down the middle of one flat face, and the groove shows high polish from use.

K.H. 458 (Pl. 41, Fig. 3) is about half an oval sandstone disk similar to K.H. 455 and 456 above. It has two grooves running longways down each flat face.

K.H. 457 (Pl. 41, Fig. 4) is a fragment of ferricrete grinder about 100 mm. wide which had a marked cavity on one face. On the other side are two parallel well-rounded grooves about 15 mm. wide and 5 mm. maximum depth.

M 25 (6) (Pl. 40, Fig. 6), which came from conventional layer 60–80 cm., is a unique object which does not necessarily date from the early settlement. It is of limestone unlike anything found anywhere near Khartoum and is 136 mm. long and 50 mm. in maximum diameter. It has been shaped artificially by flaking, is very roughly celtiform, and has a blunted cutting-edge made by the removal of intersecting flakes at one end. Down the length of one side it has a pronounced approximately

rectangular groove made by rubbing, the angle of which has been rounded and slightly deepened by rubbing an object of about 5 mm. diameter in it.

LOWER GRINDSTONES

The question as to exactly what kinds of lower grindstones were used by the people of this culture must await the excavation of a site that has been less eroded and disturbed than the present site. One lower grindstone of the type still in use in the Sudan (Arabic: *murhāka*), a slab of silcrete sandstone (maximum length 590 mm., maximum width 295 mm., and maximum thickness 85 mm.) evenly hollowed by grinding on one side, and quite rough on the back and edges, was found in use as a gravestone for one of the Moslem graves from the siege of Khartoum, but there is no evidence to connect it with the early settlement, and it has been catalogued in the Khartoum Museum Ethnological Collection as II. 2119 (Pl. 42, Fig. 1).

In fact it is different in almost every way from the fragments of apparent lower grindstones of sandstone that showed wear from rubbing and grinding and that were associated with the early site.

These fragments were remarkably few in number—far fewer than the complete upper grindstones, grinders, or rubbers. All fragments that showed any feature at all were kept for examination, and these total 156 as against at least 278 complete upper grindstones, grinders, or rubbers of sandstone (excluding hammer-stones of gneiss, &c.), and 280 fragments.

Practically every fragment appears from partial concretion of the broken edges to have been broken in the time of the early settlement, although many a fragment does seem to have been broken after the slab from which it comes had been hollowed by use as a lower grindstone, for the edge where the fracture meets the curved smoothed surface is sharp.

That there never were many lower grindstones of the usual saddle-quern type is suggested by the small number of fragments, and the fact that no fragment is too large to be conveniently spanned by the fingers of one hand, while many have the edges worn and rounded, as if used in the right hand as grinders, possibly after the original grindstone had been broken; for it would seem unlikely for the edges of a lower grindstone to become much worn and rounded with use, if used as a saddle-quern for grinding grain or clay. Further, in a large proportion of the fragments, the smooth worn surface is not all in one plane, as it would be if broken from a lower grindstone used simply for grinding—and in these cases it seems that the wear has been uneven from use in several directions as a rubber, rather than in a constant direction as in the case of a lower grindstone used for grinding grain.

We have noticed upper grindstones, grinders, &c., which have one surface concave and appear to have been used as small lower grindstones as well (see p. 57). We also noticed on p. 57 K.H. 1317, a roughly circular disk (maximum diameter 120 mm., maximum thickness 52 mm.) which appeared to have been used rather as a lower grindstone than as anything else, and certainly not as a true upper grindstone. Five fragments were found, including one from conventional layer 100–10 cm. in square M 26, which could have come from similar small, thick, circular, lower grindstones.

A few quadrilateral fragments of slab sandstone have a more or less regular circular pitting in the smooth upper surface. Several other irregular roughly quadrilateral fragments with maximum diameter from 90 to 140 mm. were found that have a concavity on the smooth side indicating that the fragment was used as a small lower grindstone after fracture. See Pl. 42, Fig. 2, for an example from 170 cm. deep in square M 22. Two other approximately rectangular fragments with sides varying from 60 to 65 mm. have artificial pitting to a depth of about 3 mm. and a diameter of 10 mm. in the centre of the smooth flat surface.

Several other less regular fragments have rough artificial pitting in the centre of the smooth face. All these fragments therefore would seem to have been used after fracture.

One regular quadrilateral fragment K.H. 308 (Pl. 43, Fig. 1) (maximum length 126 mm., maximum width 82 mm., maximum thickness 40 mm.) was certainly used after fracture both as an upper and a lower grindstone and probably as a grinder as well. There is some artificial roughening in the middle of one slightly concave smooth face, and the convex face clearly shows use as an upper grindstone. One short side is completely rounded with use, and the edges of the other three sides where fracture occurred have lost their sharpness.

The remaining fragments (all of silcrete or ferricrete sandstone) are no two of them alike and can only be classified roughly as follows:

(*a*) Twenty-eight are flat and thin (maximum thickness 25 mm.) and could have come from a flat oval grindstone such as that found by Vignard (1923, pl. XIV *bis* and pp. 24–5) at Kom Ombo in the second level of the Sebilian, and which, although it had traces of ochre on it, he took to be evidence that the Sebilians ground grain, although this seems doubtful. Like the Sebilian example these flat fragments have almost all been used on both sides, but the largest, K.H. 314 (Pl. 42, Fig. 4), measures approximately 160 × 90 mm., and has a rounded edge, as has another fragment, K.H. 330 (Pl. 42, Fig. 5), which measures 130 × 60 mm. Both these are very smooth and become thin towards what must have been the centre of the lower grindstone from which they came; and the last 40 mm. gets progressively thinner towards the rounded outer edge, as in the case of a remarkable flat lower grindstone (Pl. 42, Fig. 3) brought in from the Wadi Howar by W. B. K. Shaw (Khartoum Antiquities Collection Catalogue No. 3458). This grindstone has a regular roughened oval hollow (possibly for collecting the powdered pigment in) approximately 150 × 350 mm. in the centre, where the thickness is only 5 mm., whereas near the rim the thickness is 28 mm. The overall dimensions are 590 × 365 mm. Most of the area between the central depression and the rim has been smoothed with use, except where for nearly half of that area it has been artificially roughened with diffuse pitting. It seems possible that the early Khartoum settlement used such flat lower grindstones, and that, as in the case of the Sebilian example, they were used for grinding ochre. This Wadi Howar grindstone is quite flat on the other side, which may have been used to a limited extent, for most of the flat fragments from the early settlement have been used on both sides.

K.H. 453 (Pl. 43, Fig. 2) is a flat fragment 32 mm. thick with a rounded edge, maximum length 115 mm., maximum width 66 mm., that has marked sporadic pitting on each face and seems to have been used since fracture.

The other fragments suggest a thicker type of lower grindstone also possibly with a more or less rounded edge, unlike the modern *murhāka*, and with a deeper smoother concavity reminiscent of a shallow bowl. They include:

(*b*) Twenty-one fragments showing a rounded outer edge, and used only on one side. The largest fragments were:

K.H. 315 (Pl. 43, Fig. 3), maximum breadth 158 mm., maximum depth 110 mm., maximum thickness 47 mm. It has a small pit in the smooth surface, part of which seems to have been still used as a lower grindstone after fracture and worn by a small upper grindstone into a transverse groove in the centre of which is the pit. It is of silcrete sandstone. The surface of the fracture is calcreted. The outer edge, which is rough, seems to have been roughly rounded before fracture.

K.H. 327 (Pl. 43, Fig. 4) is of silcrete sandstone also with a roughly rounded edge along what appears to have been the outside edge of the lower grindstone. It is only slightly concave on the smooth upper side and does not appear to have been used much before it was broken, although the surface of the fractures is, as usual, calcreted; maximum length 150 mm., maximum breadth 100 mm., and maximum thickness 53 mm.

(*c*) Five rim fragments, only used on one side, have a particularly smooth face for a depth of 40 to

50 mm. in immediate proximity to what appears to have been the roughly rounded outer edge of the original grindstone (see Pl. 44, Figs. 1–4). This particularly smooth face is at a marked angle to the plane of what is left of the shallow concavity of the original lower grindstone, and appears to have been caused by the subsequent use of the fragment as an upper grindstone held at an angle to some lower grindstone.

(*d*) There are eleven fragments of what appears to have been the roughly rounded outer edge of a lower grindstone that has had some use on the side opposite the smooth concave face. The largest fragment has maximum length 140 mm., maximum width 130 mm., and maximum thickness 50 mm. See two examples, K.H. 310 and K.H. 313, in Pl. 44, Figs. 5–6.

One fragment, K.H. 261 (Pl. 36, Fig. 22), looks as if it may have been part of a shallow stone bowl or dish.

(*e*) Two rim fragments from lower grindstones that have been used on both sides have an exceptionally smooth face near the rim at a marked angle to the main concavity, as in (*c*), e.g. K.H. 326 in Pl. 44, Fig. 7.

(*f*) Nine fragments from the body of lower grindstones used on one side only.

(*g*) Fifty-two fragments from the body of lower grindstones which have been used on both sides. Most of the fragments are not large, and the largest measures 90 mm. by 85 mm. by 20 mm. thick.

(*h*) It was difficult to decide whether to include here, or on p. 62 with the grinders with a regular circular depression in each face, the unusual fragment K.H. 209 (Pl. 36, Fig. 21, and Pl. 45, Fig. 1) which has a regular shallow depression with a flat bottom on one side, and a shallow depression with rounded base on the opposite side. The maximum depth of the depressions is from 6 to 7 mm., and the maximum diameter of the depressions is 80 mm., while the maximum diameter of the fragment is 115 mm. Thus it seems that this artifact was probably used as a lower grindstone or as a palette on either side.

With it may be classed another unusual fragment, K.H. 254 (Pl. 45, Fig. 2), which appears to be part of an oval grinder with a rounded end and a sharp keel along each long side, while on either side there is an oval depression of a maximum depth of 4 mm. and maximum diameter 35 mm., the maximum diameter of the fragment being 55 mm., and the length of the fragment 40 mm., indicating a total length of at least 80 mm. The maximum thickness is 23 mm. (See also p. 118.)

COMPARATIVE NOTES ON THE INDUSTRY

In the absence at Khartoum of any comparative material from the Upper Sebilian of Egypt or the Capsian of north Africa, a thorough study of the relations of the Khartoum industry to other industries must be left to others. It appears, however, probable that it comes, as would be natural from its geographical position, between the Capsian of north Africa and the Wilton of Rhodesia and south Africa.

The stone industry associated with the barbed bone spear-heads from Taferjit and Tamaya Mellet in the Sahara Nigérien of west Africa, which so closely resemble the barbed bone spear-heads from this Khartoum site, includes tanged and recessed-base arrow-heads and polished celts (Harper Kelley, 1934, pp. 135 ff.). These differ so completely from the Khartoum industry that I thought they must be relics of a different period confused on the surface with objects of an earlier date, until I received a personal communication from M. Henri Lhote, who carried out excavations at those sites in 1934 and 1935, confirming their association (but see pp. 112 and 118).

In the Sebilian and Capsian the chief material was flint, and in the Kenya Aurignacian (now to be called Kenya Capsian) the material was obsidian. Both flint and obsidian are much easier to work